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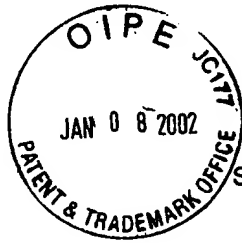
BLAKELY SOKOLOFF TAYLOR & ZAFMAN

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07 January 2002

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DENVER, CO

James Thein, Esq.
United States Patent and Trademark Office
Washington D.C. 20231

Via Federal Express

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JAN 15 2002

Re: Application No.: 09/755,483 Filed 05 January 2001
In the name of SONG, Deyang, et al.
METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST
NETWORK
Our Ref: 005416.P001

Technology Center 2600

Dear Jim:

We internationally filed the above referenced case under the Patent Cooperation Treaty (PCT) on 07 November 2001. A request for non-publication under Rule 35 USC 122 (b)(2)(B)(i) was filed in the US case on 05 January 2001 and pursuant to Rule 35 USC 122 (b)(2)(B)(ii), we have filed a Request to Rescind Previous request.

However, the 45 day deadline to file the Rescind statement was 22 December 2001, which carried over to 26 December 2001, due to the Holiday and weekend date that it fell on. We filed the Rescind Statement on 28 December 2001, thereby unintentionally missing the deadline by two days.

We note that pursuant to Rule 35 USC (b)(2)(B)(iii), "A failure of the applicant to provide such notice within the prescribed period shall result in the application being regarded as abandoned, unless it is shown to the satisfaction of the Director that the delay in submitting the notice was unintentional". A copy of the Rule is attached. I would appreciate you finding out if we can rectify this problem.

Enclosed please find a complete copy of the US file and a copy of the PCT Request as filed, including true copies of the Express Mail slip and Return post card. Also enclosed are the executed PCT General Power of Attorney forms in the names of Deyang Song and Shoudan Liang. We have not yet received the International serial number.

Thank you in advance for your assistance in this matter.

Very truly yours,

Blakely, Sokoloff, Taylor & Zafman LLP


Sandi Wilson

Manager, International Department

[Search USC](#), [About Database](#), [Download USC](#), [Classification Tables](#), [Codification](#)



Go to 1st query term(s)

-CITE-

35 USC Sec. 122

01/23/00

-EXPCITE-

TITLE **35** - PATENTS

PART II - PATENTABILITY OF INVENTIONS AND GRANT OF PATENTS

CHAPTER 11 - APPLICATION FOR PATENT

-HEAD-

Sec. **122**. Confidential status of applications; publication of
patent applications

-STATUTE-

(a) Confidentiality. - Except as provided in subsection (b), applications for patents shall be kept in confidence by the Patent and Trademark Office and no information concerning the same given without authority of the applicant or owner unless necessary to carry out the provisions of an Act of Congress or in such special circumstances as may be determined by the Director.

(b) Publication. -

(1) In general. - (A) Subject to paragraph (2), each application for a patent shall be published, in accordance with procedures determined by the Director, promptly after the expiration of a period of 18 months from the earliest filing date for which a benefit is sought under this title. At the request of the applicant, an application may be published earlier than the end of such 18-month period.

(B) No information concerning published patent applications shall be made available to the public except as the Director determines.

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(C) Notwithstanding any other provision of law, a determination by the Director to release or not to release information concerning a published patent application shall be final and nonreviewable.

(2) Exceptions. - (A) An application shall not be published if that application is -

- (i) no longer pending;
- (ii) subject to a secrecy order under section 181 of this title;
- (iii) a provisional application filed under section 111(b) of this title; or
- (iv) an application for a design patent filed under chapter 16 of this title.

(B) (i) If an applicant makes a request upon filing, certifying that the invention disclosed in the application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication of applications 18 months after filing, the application shall not be published as provided in paragraph (1).

(ii) An applicant may rescind a request made under clause (i) at any time.

(iii) An applicant who has made a request under clause (i) but who subsequently files, in a foreign country or under a multilateral international agreement specified in clause (i), an application directed to the invention disclosed in the application filed in the Patent and Trademark Office, shall notify the Director of such filing not later than 45 days after the date of the filing of such foreign or international application. A failure of the applicant to provide such notice

within the prescribed period shall result in the application being regarded as abandoned, unless it is shown to the satisfaction of the Director that the delay in submitting the notice was unintentional.

(iv) If an applicant rescinds a request made under clause (i) or notifies the Director that an application was filed in a foreign country or under a multilateral international agreement specified in clause (i), the application shall be published in accordance with the provisions of paragraph (1) on or as soon as is practical after the date that is specified in clause (i).

(v) If an applicant has filed applications in one or more foreign countries, directly or through a multilateral international agreement, and such foreign filed applications corresponding to an application filed in the Patent and Trademark Office or the description of the invention in such foreign filed applications is less extensive than the application or description of the invention in the application filed in the Patent and Trademark Office, the applicant may submit a redacted copy of the application filed in the Patent and Trademark Office eliminating any part or description of the invention in such application that is not also contained in any of the corresponding applications filed in a foreign country. The Director may only publish the redacted copy of the application unless the redacted copy of the application is not received within 16 months after the earliest effective filing date for which a benefit is sought under this title. The provisions of section 154(d) shall not apply to a claim if the description of the invention published in the redacted application filed under this clause with respect to the claim does not enable a person skilled in the art to make and use the subject matter of the

claim.

(c) Protest and Pre-Issuance Opposition. - The Director shall establish appropriate procedures to ensure that no protest or other form of pre-issuance opposition to the grant of a patent on an application may be initiated after publication of the application without the express written consent of the applicant.

(d) National Security. - No application for patent shall be published under subsection (b)(1) if the publication or disclosure of such invention would be detrimental to the national security. The Director shall establish appropriate procedures to ensure that such applications are promptly identified and the secrecy of such inventions is maintained in accordance with chapter 17 of this title.

-SOURCE-

(July 19, 1952, ch. 950, 66 Stat. 801; Pub. L. 93-596, Sec. 1, Jan. 2, 1975, 88 Stat. 1949; Pub. L. 106-113, div. B, Sec. 1000(a)(9) (title IV, Sec. 4502(a)), Nov. 29, 1999, 113 Stat. 1536, 1501A-561.)

-MISC1-

HISTORICAL AND REVISION NOTES

This section enacts the Patent Office rule of secrecy of applications.

AMENDMENTS

1999 - Pub. L. 106-113 amended section catchline and text generally. Prior to amendment, text read as follows:

'Applications for patents shall be kept in confidence by the Patent and Trademark Office and no information concerning the same given without authority of the applicant or owner unless necessary to carry out the provisions of any Act of Congress or in such special circumstances as may be determined by the Commissioner.'

1975 - Pub. L. 93-596 substituted ''Patent and Trademark Office'' for ''Patent Office''.

EFFECTIVE DATE OF 1999 AMENDMENT

Amendment by Pub. L. 106-113 effective on date that is 1 year after Nov. 29, 1999, and applicable to all applications filed under section 111 of this title on or after that date, and all applications complying with section 371 of this title that resulted from international applications filed on or after that date, see section 1000(a)(9) (title IV, Sec. 4508) of Pub. L. 106-113, set out as a note under section 10 of this title.

EFFECTIVE DATE OF 1975 AMENDMENT

Amendment by Pub. L. 93-596 effective Jan. 2, 1975, see section 4 of Pub. L. 93-596, set out as a note under section 1111 of Title 15, Commerce and Trade.

STUDY OF APPLICANTS FILING ONLY IN UNITED STATES

Pub. L. 106-113, div. B, Sec. 1000(a)(9) (title IV, Sec. 4502(b)), Nov. 29, 1999, 113 Stat. 1536, 1501A-562, provided that:

''(1) In general. - The Comptroller General shall conduct a 3-year study of the applicants who file only in the United States on or after the effective date of this subtitle (see section 1000(a)(9) (title IV, Sec. 4508) of Pub. L. 106-113, set out as an Effective Date of 1999 Amendment note under section 10 of this title) and shall provide the results of such study to the Judiciary Committees of the House of Representatives and the Senate.

''(2) Contents. - The study conducted under paragraph (1) shall -

''(A) consider the number of such applicants in relation to the number of applicants who file in the United States and outside of the United States;

''(B) examine how many domestic-only filers request at the time of filing not to be published;

''(C) examine how many such filers rescind that request or later choose to file abroad;

''(D) examine the status of the entity seeking an application and any correlation that may exist between such status and the publication of patent applications; and

''(E) examine the abandonment/issuance ratios and length of application pendency before patent issuance or abandonment for published versus unpublished applications.''

-SECRET-

SECTION REFERRED TO IN OTHER SECTIONS

This section is referred to in sections 2, 5, 102, 135, 154, 374 of this title.



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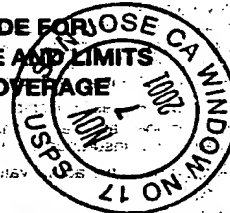
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TRANSMITTAL LETTER TO THE
UNITED STATES RECEIVING OFFICE

Date	07 November 2001
Int'l Application No.	***
Attorney Docket No.	5416.P001

I. Certification under 37 CFR 1.10 (if applicable)

EL 541 973 866 US
Express Mail Mailing No.

07 November 2001	JAN 15 2002
Date of Deposit	Technology Center 2600

I hereby certify that the application/correspondence attached hereto is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Signature of person mailing correspondence
--

Sandi K. Wilson
Typed or printed name of person mailing correspondence

II. ☒ New International Application

TITLE	METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK	Earliest priority date (Day/Month/Year)
		05 January 2001

SCREENING DISCLOSURE INFORMATION: In order to assist in screening the accompanying international application for purposes of determining whether a license for foreign transmittal should and could be granted and for other purposes, the following information is supplied. (Note: check as many boxes as apply):

- A. ☐ The invention disclosed was not made in the United States.
B. ☐ There is no prior U.S. application relating to this invention.
C. ☒ The following prior U.S. application(s) contain subject matter which is related to the invention disclosed in the attached international application. (NOTE: priority to these applications may or may not be claimed on form PCT/RO/101 (Request) and this listing does not constitute a claim for priority)

application no.	09/755,483	filed on	05 January 2001 (05.01.01)
application no.		filed on	

- D. ☐ The present international application ☐ is identical to ☐ contains less subject matter than that found in the prior U.S. application(s) identified in paragraph C above.
E. ☐ The present international application ☐ contains additional subject matter not found in the prior U.S. application(s) identified in paragraph C above. The additional subject matter is found on pages and ☐ DOES NOT ALTER ☐ MIGHT BE CONSIDERED TO ALTER the general nature of the invention in a manner which would require the U.S. application to have been made available for inspection by the appropriate defense agencies under 35 U.S.C. 181 and 37 CFR 5.1. See 37 CFR 5.15.

III. ☐ A Response to an Invitation from the RO/US.

The following document(s) is(are) enclosed.

- A. ☐ A Request for An Extension of Time to File a Response
B. ☐ A Power of Attorney (General or Regular)
C. ☐ Replacement pages:

pages		of the request (PCT/RO/101)	pages		of the figures
pages		of the description	pages		of the abstract
pages		of the claims			

- D. ☐ Submission of Priority Documents

Priority document		Priority document	
-------------------	--	-------------------	--

- E. ☐ Fees as specified on attached Fee Calculation sheet form PCT/RO/101 annex

IV. ☐ A Request for Rectification under PCT Rule 91

☐ A Petition ☐ A Sequence Listing Diskette

V. ☐ Other (please identify):

The person
signing this
form is the:

- ☐ Applicant Name
☒ Attorney/Agent 36,591
☐ Common Representative

Michael J. Mallie
Typed name of signer

Signature

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

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JAN 15 2002

International Filing Date

Technology Center 2600

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference
(if desired) (12 characters maximum)

5416.P001

Box N . I TITLE OF INVENTION

METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK

Box N . II APPLICANT

Name and Address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

SONG, DEYANG

14 Oxford Place

Belmont, California 94002

United States of America

☒ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State (that is, country) of nationality:

CN

State (that is, country) of residence:

US

This person is applicant
for the purpose of:

☒ all designated
States

☐ all designated States except
the United States of America

☐ the United States
of America only

☐ the States indicated in
the Supplemental box

Box N . III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and Address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

LIANG, Shoudan

280 Parkside Drive

Palo Alto, California 94306

United States of America

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only (If this check-box
is marked, do not fill in below.)

State (that is, country) of nationality:

US

State (that is, country) of residence:

US

This person is applicant
for the purpose of:

☒ all designated
States

☐ all designated States except
the United States of America

☐ the United States
of America only

☐ the States indicated in
the Supplemental box

☐ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box N . IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf
of the applicant(s) before the competent International Authorities as:

☒ agent

☐ common representative

Name and Address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

MALLIE, Michael J.

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

12400 Wilshire Boulevard

7th Floor

Los Angeles, California 90025

United States of America

Telephone No.

408-720-8300

Facsimile No.

408-720-9397

Teleprinter No.

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

Regional Patent

- ☒ **AP** **ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, MZ Mozambique, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ **EA** **Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP** **European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, TR Turkey, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ **OA** **OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment is desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

- | | |
|---|---|
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| <input checked="" type="checkbox"/> AG Antigua and Barbuda | <input checked="" type="checkbox"/> LR Liberia |
| <input checked="" type="checkbox"/> AL Albania | <input checked="" type="checkbox"/> LS Lesotho |
| <input checked="" type="checkbox"/> AM Armenia | <input checked="" type="checkbox"/> LT Lithuania |
| <input checked="" type="checkbox"/> AT Austria | <input checked="" type="checkbox"/> LU Luxembourg |
| <input checked="" type="checkbox"/> AU Australia | <input checked="" type="checkbox"/> LV Latvia |
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| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina | <input checked="" type="checkbox"/> MD Republic of Moldova |
| <input checked="" type="checkbox"/> BB Barbados | <input checked="" type="checkbox"/> MG Madagascar |
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| <input checked="" type="checkbox"/> BR Brazil | <input checked="" type="checkbox"/> MN Mongolia |
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| <input checked="" type="checkbox"/> CR Costa Rica | <input checked="" type="checkbox"/> PL Poland |
| <input checked="" type="checkbox"/> CU Cuba | <input checked="" type="checkbox"/> PT Portugal |
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| <input checked="" type="checkbox"/> DK Denmark | <input checked="" type="checkbox"/> SD Sudan |
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| <input checked="" type="checkbox"/> DZ Algeria | <input checked="" type="checkbox"/> SG Singapore |
| <input checked="" type="checkbox"/> EE Estonia | <input checked="" type="checkbox"/> SI Slovenia |
| <input checked="" type="checkbox"/> ES Spain | <input checked="" type="checkbox"/> SK Slovakia |
| <input checked="" type="checkbox"/> FI Finland | <input checked="" type="checkbox"/> SL Sierra Leone |
| <input checked="" type="checkbox"/> GB United Kingdom | <input checked="" type="checkbox"/> TJ Tajikistan |
| <input checked="" type="checkbox"/> GD Grenada | <input checked="" type="checkbox"/> TM Turkmenistan |
| <input checked="" type="checkbox"/> GE Georgia | <input checked="" type="checkbox"/> TR Turkey |
| <input checked="" type="checkbox"/> GH Ghana | <input checked="" type="checkbox"/> TT Trinidad and Tobago |
| <input checked="" type="checkbox"/> GM Gambia | <input checked="" type="checkbox"/> TZ United Republic of Tanzania |
| <input checked="" type="checkbox"/> HR Croatia | <input checked="" type="checkbox"/> UA Ukraine |
| <input checked="" type="checkbox"/> HU Hungary | <input checked="" type="checkbox"/> UG Uganda |
| <input checked="" type="checkbox"/> ID Indonesia | <input checked="" type="checkbox"/> US United States of America |
| <input checked="" type="checkbox"/> IL Israel | <input checked="" type="checkbox"/> UZ Uzbekistan |
| <input checked="" type="checkbox"/> IN India | <input checked="" type="checkbox"/> VN Viet Nam |
| <input checked="" type="checkbox"/> IS Iceland | <input checked="" type="checkbox"/> YU Yugoslavia |
| <input checked="" type="checkbox"/> JP Japan | <input checked="" type="checkbox"/> ZA South Africa |
| <input checked="" type="checkbox"/> KE Kenya | <input checked="" type="checkbox"/> ZW Zimbabwe |
| <input checked="" type="checkbox"/> KG Kyrgyzstan | |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea | |
| <input checked="" type="checkbox"/> KR Republic of Korea | |
| <input checked="" type="checkbox"/> KZ Kazakstan | |
| <input checked="" type="checkbox"/> LC Saint Lucia | |

Check-box reserved for designating States (for purposes of a national patent) which have become party to the PCT after issuance of this sheet:

- ☒ **Colombia, Ecuador, Philippines**
- ☒ **And any State that has become bound by the PCT since the Issuance of this form.**

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)

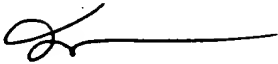
Supplemental B x *If the Supplemental Box is not used, this sheet need not be included in the request.*

1. If, in any of the Boxes, the space is insufficient to furnish all the information: in such case, write "Continuation of Box No. ..." [indicate the number of the Box] and furnish the information in the same manner as required according to the captions of the Box in which the space was insufficient; in particular:
- (i) if more than two persons are involved as applicants and/or inventors and no "continuation sheet" is available: in such case, write "Continuation of Box No. III" and indicate for each additional person the same type of information as required in Box No. III. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below;
 - (ii) if, in Box No. II or in any of the sub-boxes of Box No. III, the indication "the States indicated in the Supplemental Box" is checked: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the applicant(s) involved and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is applicant;
 - (iii) if, in Box No. II or in any of the sub-boxes of Box No. III, the inventor or the inventor/applicant is not inventor for the purposes of all designated States or for the purposes of the United States of America: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the inventor(s) and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is inventor;
 - (iv) if, in addition to the agent(s) indicated in Box No. IV, there are further agents: in such case, write "Continuation of Box No. IV" and indicate for each further agent the same type of information as required in Box No. IV;
 - (v) if, in Box No. V, the name of any State (or OAPI) is accompanied by the indication "patent of addition," or "certificate of addition," or if, in Box No. V, the name of the United States of America is accompanied by an indication "continuation" or "continuation-in-part": in such case, write "Continuation of Box No. V" and the name of each State involved (or OAPI), and after the name of each such State (or OAPI), the number of the parent title or parent application and the date of grant of the parent title or filing of the parent application;
 - (vi) if, in Box No. VI, there are more than three earlier applications whose priority is claimed: in such case, write "Continuation of Box No. VI" and indicate for each additional earlier application the same type of information as required in Box No. VI;
 - (vii) if, in Box No. VI, the earlier application is an ARIPO application: in such case, write "Continuation of Box No. VI", specify the number of the item corresponding to that earlier application and indicate at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed.
2. If, with regard to the precautionary designation statement contained in Box No. V, the applicant wishes to exclude any State(s) from the scope of that statement: in such case, write "Designation(s) excluded from precautionary designation statement" and indicate the name or two-letter code of each State so excluded.
3. If the applicant claims, in respect of any designated Office, the benefits of provisions of the national law concerning non-prejudicial disclosures or exceptions to lack of novelty: in such case, write "Statement concerning non-prejudicial disclosures or exceptions to lack of novelty" and furnish that statement below.

Continuation of Box No. IV

Alford, William E.; Amini, Farzad E.; Babbitt, William Thomas; Barry, Carol F.; Becker, Jordan Michael; Berezna, Bradley J.; Bernadacou, Michael A.; Blakely, Roger W. Jr.; Caldwell, Gregory D.; Coester, Thomas M.; DeSanctis, Michael Anthony; De Vos, Daniel M.; Fahmi, Tarek N.; Ferrill, Thomas S.; Go, James Y.; Holbrow, Willmore F. III; Hoover, George W II; Hyman, Eric S.; Kidd, William W.; Mallie, Michael J.; Marais, Andre L.; Mendonsa, Paul A.; Nguyen, Thinh V.; Nicholls, Dennis A.; O'Rourke, Robert; Ovanezian, Daniel E.; Salter, James H.; Schaal, William W.; Scheller, James C., Jr.; Smith, Jeffrey Sam; Sobrino, Maria McCormack; Sokoloff, Stanley W.; Szepesi, Judith A.; Taylor, Edwin H.; Vincent, Lester J.; Von Tersch, Glenn E.; Ward, John Patrick; Weigell, Charles T. J.; Yates, Steven D.; and Zafman, Norman; my patent attorneys, and Henry, James A.; my patent agent, of BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP, with offices located at 12400 Wilshire Boulevard, 7th Floor, Los Angeles, California 90025, telephone (408) 720-8598, and James R. Thein, my patent attorney.

(all at the address listed in Box IV)

Box No. VI PRIORITY CLAIM			<input type="checkbox"/> Further priority claims are indicated in the Supplemental Box	
Filing date of earlier application (day/month/year)	Number of earlier application	national application country	Where earlier application is:	
			regional application:* regional Office	international application: receiving Office
item (1) 05 January 2001 (05.01.01)	09/755,483	US		
item (2)				
<input checked="" type="checkbox"/> The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international is the receiving Office) identified above as item(s): (1)				
<small>*Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.</small>				
Box No. VII INTERNATIONAL SEARCHING AUTHORITY				
Check International Searching Authority (ISA) (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used): ISA / EP		Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority): Date (day/month/year) Number Country (or regional Office)		
Box No. VIII CHECK LIST; LANGUAGE OF FILING				
This international application contains the following number of sheets:		This international application is accompanied by the item(s) marked below:		
request	: 4 sheets	1. <input checked="" type="checkbox"/> fee calculation sheet		
description (excluding sequence listing part)	: 21 sheets	2. <input type="checkbox"/> separate signed power of attorney		
claims	: 4 sheets	3. <input type="checkbox"/> copy of general power of attorney; reference no. if any:		
abstract	: 1 sheets	4. <input type="checkbox"/> statement explaining lack of signature		
drawings	: 4 sheets	5. <input type="checkbox"/> priority document(s) identified in Box No. VI as item(s):		
sequence listing part of description	: sheets	6. <input type="checkbox"/> translation of international application into (language):		
Total number of sheets	: 34 sheets	7. <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material		
		8. <input type="checkbox"/> nucleotide and/or amino acid sequence listing in computer readable form		
		9. <input checked="" type="checkbox"/> other (specify) : PTO-1382, postcard,		
Figure of drawings which should accompany the abstract:		Language of filing of the international application: English		
Box No. IX SIGNATURE OF APPLICANT OR AGENT				
Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).				
 Michael J. Mallie				
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1. Date of actual receipt of the purported international application:			2. Drawings: <input type="checkbox"/> received: <input type="checkbox"/> not received:	
3. Corrected date of actual receipt due to later but timely received papers or drawings completed the purported international application:				
4. Date of timely receipt of the required corrections under PCT Article 11(2):				
5. International Searching Authority (if two or more are competent): ISA/		6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid		
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FEE CALCULATION SHEET Annex to the Request

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International application No.

Date stamp of the receiving Office

Applicant's or agent's
file reference

5416.P001

Applicant

SONG, DEYANG

CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE 240.00 **T**

2. SEARCH FEE 846.00 **S**

International search to be carried out by EP
(If two or more International Searching Authorities are competent in relation to the international application, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

Basic Fee

The international application contains 34 sheets.

first 30 sheets 382.00 **b₁**

4 x 9 = 36.00 **b₂**

remaining sheets additional amount

Add amounts entered at **b₁** and **b₂** and enter total at **B** 418.00 **B**

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6 x 82 = 492.00 **D**

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5416.P001PCT - Song, Deyang & Liang, Shoudan
MJM - SKW/jls
PCT Application filing fee
METHOD FOR DIGITAL MEDIA PLAYBACK IN S BROADCAST NETWORK
Inventors: Song and Liang
USSN.: 09/755,483 Filed 05 January 2001
Ex Mail No.: EL 541 973 866 US

46366 ✓

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GENERAL POWER OF ATTORNEY

(For an international application filed under the Patent Cooperation Treaty)

(PCT Rule 90.5)

The undersigned person(s):

(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

SONG, Deyang
14 Oxford Place
Belmont, California 94002
United States of America

hereby appoint(s) the following person as

☒ agent

☐ common representative

Name and address

(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

William E. Alford, Reg. No. 37,764; Farzad E. Amini, Reg. No. 42,261; William Thomas Babbitt, Reg. No. 39,591; Carol F. Barry, Reg. No. 41,600; Jordan Michael Becker, Reg. No. 39,602; Lisa N. Benado, Reg. No. 39,995; Bradley J. Berezna, Reg. No. 33,474; Michael A. Bernadacou, Reg. No. 35,934; Roger W. Blakely, Jr., Reg. No. 25,831; R. Alan Burnett, Reg. No. 46,149; Gregory D. Caldwell, Reg. No. 39,926; Andrew C. Chen, Reg. No. 43,544; Thomas M. Coester, Reg. No. 39,637; Donna Jo Coningsby, Reg. No. 41,684; Florin Corie, Reg. No. 46,244; Dennis M. deGuzman, Reg. No. 41,702; Stephen M. De Klerk, Reg. No. 46,503; Michael Anthony DeSanctis, Reg. No. 39,957; Daniel M. De Vos, Reg. No. 37,813; Sanjeet Dutta, Reg. No. 46,145; Matthew C. Fagan, Reg. No. 37,542; Tarek N. Fahmi, Reg. No. 41,402; George Fountain, Reg. No. 37,374; James Y. Go, Reg. No. 40,621; James A. Henry, Reg. No. 41,064; Libby N. Ho, Reg. No. 46,774; Willmore F. Holbrow III, Reg. No. 41,845; Sheryl Sue Holloway, Reg. No. 37,850; George W. Hoover II, Reg. No. 32,992; Eric S. Hyman, Reg. No. 30,139; William W. Kidd, Reg. No. 31,772; Sang Hui Kim, Reg. No. 40,450; Walter T. Kim, Reg. No. 42,731; Eric T. King, Reg. No. 44,188; George Brian Leavell, Reg. No. 45,436; Kurt P. Leyendecker, Reg. No. 42,799; Gordon R. Lindeen III, Reg. No. 33,192; Jan Carol Little, Reg. No. 41,181; Robert G. Liits, Reg. No. 46,876; Joseph Lutz, Reg. No. 43,765; Michael J. Mallie, Reg. No. 36,591; Andre L. Marais, Reg. No. P48,095; Paul A. Mendonsa, Reg. No. 42,879; Clive D. Menezes, Reg. No. 45,493; Chun M. Ng, Reg. No. 36,878; Thien T. Nguyen, Reg. No. 43,835; Thinh V. Nguyen, Reg. No. 42,034; Dennis A. Nicholls, Reg. No. 42,036; Rob O'Rourke, Reg. No. 46,972; Daniel E. Ovanezian, Reg. No. 41,236; Kenneth B. Paley, Reg. No. 38,989; Gregg A. Peacock, Reg. No. 45,001; Marina Portnova, Reg. No. 45,750; William F. Ryann, Reg. No. 44,313; James H. Salter, Reg. No. 35,668; William W. Schaal, Reg. No. 39,018; James C. Scheller, Reg. No. 31,195; Jeffrey Sam Smith, Reg. No. 39,377; Maria McCormack Sobrino, Reg. No. 31,639; Stanley W. Sokoloff, Reg. No. 25,128; Judith A. Szepesi, Reg. No. 39,393; Vincent P. Tassinari, Reg. No. 42,179; Edwin H. Taylor, Reg. No. 25,129; John F. Travis, Reg. No. 43,203; Joseph A. Twarowski, Reg. No. 42,191; Tom Van Zandt, Reg. No. 43,219; Lester J. Vincent, Reg. No. 31,460; Glenn E. Von Tersch, Reg. No. 41,364; John Patrick Ward, Reg. No. 40,216; Mark L. Watson, Reg. No. 46,322; Thomas C. Webster, Reg. No. 46,154; and Norman Zafman, Reg. No. 26,250; my patent attorneys, and Firasat Ali, Reg. No. 45,715; Justin M. Dillon, Reg. No. 42,486; Thomas S. Ferrill, Reg. No. 42,532; and Raul Martinez, Reg. No. 46,904, my patent agents, of BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP, with offices located at 12400 Wilshire Boulevard, 7th Floor, Los Angeles, California 90025, telephone (310) 207-3800, and James R. Thein, Reg. No. 31,710, my patent attorney with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN, LLP

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United States of America

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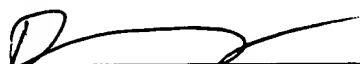
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Deyang Song

Date: 11/11/01

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(PCT Rule 90.5)

The undersigned person(s):

(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

LIANG, Shoudan
280 Parkside Drive
Palo Alto, California 94306
United States of America

hereby appoint(s) the following person as

☒ agent

☐ common representative

Name and address

(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

William E. Alford, Reg. No. 37,764; Farzad E. Amini, Reg. No. 42,261; William Thomas Babbitt, Reg. No. 39,591; Carol F. Barry, Reg. No. 41,600; Jordan Michael Becker, Reg. No. 39,602; Lisa N. Benado, Reg. No. 39,995; Bradley J. Berezna, Reg. No. 33,474; Michael A. Bernadicou, Reg. No. 35,934; Roger W. Blakely, Jr., Reg. No. 25,831; R. Alan Burnett, Reg. No. 46,149; Gregory D. Caldwell, Reg. No. 39,926; Andrew C. Chen, Reg. No. 43,544; Thomas M. Coester, Reg. No. 39,637; Donna Jo Coningsby, Reg. No. 41,684; Florin Corie, Reg. No. 46,244; Dennis M. deGuzman, Reg. No. 41,702; Stephen M. De Klerk, Reg. No. 46,503; Michael Anthony DeSanctis, Reg. No. 39,957; Daniel M. De Vos, Reg. No. 37,813; Sanjeet Dutta, Reg. No. 46,145; Matthew C. Fagan, Reg. No. 37,542; Tarek N. Fahmi, Reg. No. 41,402; George Fountain, Reg. No. 37,374; James Y. Go, Reg. No. 40,621; James A. Henry, Reg. No. 41,064; Libby N. Ho, Reg. No. 46,774; Willmore F. Holbrow III, Reg. No. 41,845; Sheryl Sue Holloway, Reg. No. 37,850; George W. Hoover II, Reg. No. 32,992; Eric S. Hyman, Reg. No. 30,139; William W. Kidd, Reg. No. 31,772; Sang Hui Kim, Reg. No. 40,450; Walter T. Kim, Reg. No. 42,731; Eric T. King, Reg. No. 44,188; George Brian Leavell, Reg. No. 45,436; Kurt P. Leyendecker, Reg. No. 42,799; Gordon R. Lindeen III, Reg. No. 33,192; Jan Carol Little, Reg. No. 41,181; Robert G. Liits, Reg. No. 46,876; Joseph Lutz, Reg. No. 43,765; Michael J. Mallie, Reg. No. 36,591; Andre L. Marais, Reg. No. 48,095; Paul A. Mendonsa, Reg. No. 42,879; Clive D. Menezes, Reg. No. 45,493; Chun M. Ng, Reg. No. 36,878; Thien T. Nguyen, Reg. No. 43,835; Thinh V. Nguyen, Reg. No. 42,034; Dennis A. Nicholls, Reg. No. 42,036; Rob O'Rourke, Reg. No. 46,972; Daniel E. Ovanezian, Reg. No. 41,236; Kenneth B. Paley, Reg. No. 38,989; Gregg A. Peacock, Reg. No. 45,001; Marina Portnova, Reg. No. 45,750; William F. Ryann, Reg. No. 44,313; James H. Salter, Reg. No. 35,668; William W. Schaal, Reg. No. 39,018; James C. Scheller, Reg. No. 31,195; Jeffrey Sam Smith, Reg. No. 39,377; Maria McCormack Sobrino, Reg. No. 31,639; Stanley W. Sokoloff, Reg. No. 25,128; Judith A. Szepesi, Reg. No. 39,393; Vincent P. Tassinari, Reg. No. 42,179; Edwin H. Taylor, Reg. No. 25,129; John F. Travis, Reg. No. 43,203; Joseph A. Twarowski, Reg. No. 42,191; Tom Van Zandt, Reg. No. 43,219; Lester J. Vincent, Reg. No. 31,460; Glenn E. Von Tersch, Reg. No. 41,364; John Patrick Ward, Reg. No. 40,216; Mark L. Watson, Reg. No. 46,322; Thomas C. Webster, Reg. No. 46,154; and Norman Zafman, Reg. No. 26,250; my patent attorneys, and Firasat Ali, Reg. No. 45,715; Justin M. Dillon, Reg. No. 42,486; Thomas S. Ferrill, Reg. No. 42,532; and Raul Martinez, Reg. No. 46,904, my patent agents, of BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP, with offices located at 12400 Wilshire Boulevard, 7th Floor, Los Angeles, California 90025, telephone (310) 207-3800, and James R. Thein, Reg. No. 31,710, my patent attorney with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN, LLP

12400 Wilshire Boulevard, 7th Floor

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United States of America

to represent the undersigned before

☒ all the competent International Authorities

☐ the International Searching Authority only

☐ the International Preliminary Examining Authority only


in connection with any and all international applications filed by the undersigned with the following Office

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and to make or receive payments on behalf of the undersigned.

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Shoudan Liang

Date: 11/11/2001

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Writer e-mail: Tarek_Fahmi@bstz.com

July 6, 2001

CONFIDENTIAL
VIA US Mail

Deyang Song
Shoudan Liang
14 Oxford Place
Belmont, CA 94002

Re: Deyang Song & Shoudan Liang
US Patent Application
Application No. 09/755,483
For: **METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST
NETWORK**
Filed: January 5, 2001
Our Ref. No.: 5416P001

Gentlemen:

Please give me a call so that we can discuss the foreign filing considerations with respect to the above U.S. patent application.

If you wish to file the above patent application in foreign countries and receive the benefit of the U.S. filing date, the foreign applications must be filed before the one year anniversary of the U.S. filing date. The foreign filing deadline for the above application is therefore January 5, 2002.

Most foreign patent laws require that there be no public use or disclosure of the invention prior to the "effective" filing date. The effective filing date corresponds to the U.S. filing date, except in a few countries.

The cost of filing a patent application in a foreign country varies from about \$2,500 in Canada to \$8,000 or more in Japan or in Germany, depending on factors such as application length, translation costs, the number of claims, and currency exchange rates. These estimates include filing fees, charges of foreign attorneys, translation costs, and our fees and expenses. Prosecution costs are not included.

Prosecution costs vary from country to country and depend upon what issues arise during prosecution. In Japan it is not unusual to spend a total of more than \$10,000 for filing and prosecution costs before one gets a patent. There will also be maintenance fees if a patent issues.

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If you plan to file in more than four European countries, you can save money and defer a country-by-country selection by filing in the European Patent Office ("EPO"). An EPO filing typically initially costs about \$9,000 to \$12,000.

A Patent Cooperation Treaty ("PCT") application can often be advantageous. The PCT provides an additional eight or eighteen months for one to enter the national/regional phase in member countries and regions. This allows one to defer most expenses of foreign filing. A PCT application also allows one to defer certain foreign filing decisions, which often results in decision making that is more informed.

The cost for filing a typical PCT application is about \$3,500. (If an optional EPO search is requested, the cost is about \$5,500). Most of the major countries are members of the PCT. PCT members include, for example, Canada, the United Kingdom, Germany, the EPO, Japan, South Korea, Australia, the People's Republic of China, Russia, Israel, and Brazil. Countries that are not members of the PCT include, for example, Chile and Taiwan.

All the above costs are only estimates and your actual expenditures may vary.

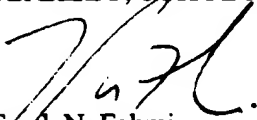
For many of the above options the patent application will be published. This may have implications with respect to trade secrets and other future patent applications.

In addition, please keep in mind that countries such as Mexico, Brazil, Argentina, Spain, and Portugal require that a patent be "worked" in the country.

Translations of patent applications take time to prepare, so I would like to hear from you by October 1, 2001, if possible.

Very truly yours,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP



Tarek N. Fahmi

TNF/pmr

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DENVER/ENGLEWOOD, CO

January 9, 2001

Confidential
Via Federal Express

Deyang Song
Shoudan Liang
14 Oxford Place
Belmont, California 94002

Re: U.S. Patent Application Entitled:
METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK
Our Ref. No.: 5416P001

Gentleman:

Enclosed please find a copy of the Application As Filed that was filed with the United States Patent Office on January 5, 2001. If you should have any questions, please do not hesitate to contact me at 408.720.8300, Ext. 328.

Very truly yours,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Patricia A. Balero
Assistant to Tarek N. Fahmi

Appln. No. 09/755,483 Filing Date 01/05/2001 BSTZ Docket# 5416 P001 Atty/Secy MJM/SKW/jls
Date Mailed 12/28/01 Docket Due Date ***** Client Deyang Song and Shoudan Liang
Title METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK

Inventor(s) Deyang Song, et al

The following has been received in the U.S. Patent & Trademark Office on the date stamped hereon:

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| <input type="checkbox"/> Appeal Brief & two copies (<u> </u> pgs each) | <input type="checkbox"/> Information Disclosure Statement & PTO-1449 (<u> </u> pgs) |
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| <u>(b)(2)(B)(ii)</u> | <input type="checkbox"/> Check No. <u> </u> Amount <u> </u> |
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28 December 2001

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VIA Express Mail


Re: USSN: 09/755,483 Filed: 05 January 2001
Applicant: SONG, Deyang
Title: METHOD FOR DIGITAL MEDIA PLAYBACK IN A
BROADCAST NETWORK
Transmittal of Request to Rescind Previous Request
Under 35 USC 122(b)(2)(B)(ii)
Our File No.: 005416.P001

Dear Sirs:

We have filed the above-identified application under the Patent Cooperation Treaty. A Request and Certification under 35 USC 122(b)(2)(B)(i) has been submitted for this invention, we herewith submit a Request to Rescind Previous Nonpublication Request under 35 USC 122(b)(2)(B)(ii).

Very truly yours,

Blakely, Sokoloff, Taylor & Zafman LLP



Michael J. Mallie
Reg. No. 36,591

MJM/jls
Enclosure

REQUEST TO RESCIND PREVIOUS NONPUBLICATION REQUEST
35 U.S.C. 122(b)(2)(B)(ii)

Application Number 09/755,483
Filing Date 05 January 2001
First Named Inventor SONG, Deyang
Title METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK

Attorney Docket No. 005416.P001
Group Art Unit _____
Examiner _____

I hereby **rescind** the previous request that the above-identified application not be published under 35 U.S.C. 122(b).

28 December 2001
Date



Signature

Michael J. Mallie
Typed or Printed Name

36,591
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This request must be signed in compliance with 37 CFR 1.33(b).

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005416.P001

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Deyang Song

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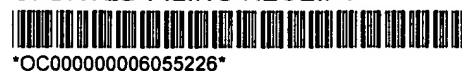
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APPLICATION NUMBER	FILING DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	DRAWINGS	TOT CLAIMS	IND CLAIMS
09/755,483	01/05/2001	2643	530	5416P001	4	35	4

CONFIRMATION NO. 5096

UPDATED FILING RECEIPT



OC000000006055226

Tarek N. Fahmi
BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP
7th Floor
12400 Wilshire Boulevard
Los Angeles, CA 90025

ENTERED

MAY 22 2001

Date Mailed: 05/08/2001

STATUS DB-LA

Receipt is acknowledged of this nonprovisional Patent Application. It will be considered in its order and you will be notified as to the results of the examination. Be sure to provide the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION when inquiring about this application. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination's Customer Service Center. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections (if appropriate).

Applicant(s)

Deyang Song, Belmont, CA;
Shoudan Liang, Palo Alto, CA;

Domestic Priority data as claimed by applicant

THIS APPLN CLAIMS BENEFIT OF 60/175,166 01/07/2000

Foreign Applications

If Required, Foreign Filing License Granted 03/02/2001

Projected Publication Date: Request for Non-Publication Acknowledged

Non-Publication Request: Yes

Early Publication Request: No

**** SMALL ENTITY ****

Title

Method for digital media playback in a broadcast network

348

Date: 05/08/2001

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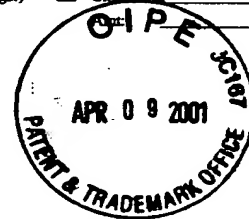
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Serial/Patent No.: 09/755,482 Filing/Issue Date: January 5, 2001
Client: LEYANG SONG & SHOU DAN LIANG
Title: METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK

BSTZ File No.: 5416P001 Atty/Sec'y Initials: TNF/lr
Date Mailed: April 6, 2001 Docket Due Date: April 5, 2001

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Serial/Patent No.: 09/755,482 Filing/Issue Date: January 5, 2001
Client: DEYANG SONG & SHOU DAN LIANG
Title: METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK

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In Re Patent Application of:)	
)	
Deyang Song, et al.)	Examiner: Not Yet Assigned
)	
Application No.: 09/755,483)	Art Unit: 2643
)	
Filed: January 5, 2001)	
)	
For: METHOD FOR DIGITAL MEDIA)	
PLAYBACK IN A BROADCAST)	
NETWORK)	
_____)	

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INFORMATION DISCLOSURE STATEMENT

Sir:

Enclosed is a copy of Information Disclosure Citation Form PTO-1449 together with copies of the documents cited on that form. It is respectfully requested that the cited documents be considered and that the enclosed copy of Information Disclosure Citation Form PTO-1449 be initialed by the Examiner to indicate such consideration and a copy thereof returned to applicant(s).

Pursuant to 37 C.F.R. § 1.97, the submission of this Information Disclosure Statement is not to be construed as a representation that a search has been made and is not

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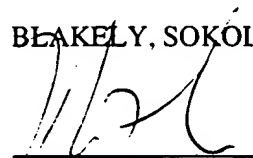
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Dated: 4/6 , 2001



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Application Number	09/755,483
Filing Date	January 5, 2005
First Named Inventor	Deyang Song
Group Art Unit	2643
Examiner Name	Not Yet Assigned
Attorney Docket Number	5416P001

Sheet 1 of 1

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Examiner Initials *	U.S. Patent Document		Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document MM-DD-YYYY	Filing Date if Appropriate
	Number				
	5,682,597		Ganek, et al.	10.28.1997	
	5,724,646		Ganek, et al.	3.3.1998	
	6,018,359		Kermode, et al.	1.25.2000	

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Serial/Patent No.: 09/755,483 Filing/Issue Date: 1/5/01
Client: DEYANG SONG & SHOUDAN LIANG
Title: METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK

BSTZ File No.: 5416P001 Atty/Sec'y Initials: TNF/pab
Date Mailed: 3/26/01 Docket Due Date: 5/5/01

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STATUS DB-LA

Serial/Patent No.: 09/755,483 Filing/Issue Date: 1/5/01
Client: DEYANG SONG & SHOU DAN LIANG
Title: METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK

BSTZ File No.: 5416P001 Atty/Secty Initials: TNF/pab
Date Mailed: 3/26/01 Docket Due Date: 5/5/01

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| <input type="checkbox"/> Application - Rule 1.53(b) CIP (____ pgs.) | <input type="checkbox"/> Petition for Extension of Time | |
| <input type="checkbox"/> Application - Rule 1.53(d) CPA Transmittal (____ pgs.) | <input type="checkbox"/> Petition for _____ | |
| <input type="checkbox"/> Application - Design (____ pgs.) | <input checked="" type="checkbox"/> Postcard | |
| <input type="checkbox"/> Application - PCT (____ pgs.) | <input type="checkbox"/> Power of Attorney (____ pgs.) | |
| <input type="checkbox"/> Application - Provisional (____ pgs.) | <input type="checkbox"/> Preliminary Amendment (____ pgs.) | |
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re of Application of:

Deyang Song et al.

Application No.: 09/755,483

Filing Date: January 5, 2001

For: METHOD FOR DIGITAL MEDIA
PLAYBACK IN A BROADCAST NETWORK

Examiner: Not Yet Assigned

Art Group: 2643

Commissioner for Patents
Washington, D.C. 20231

RESPONSE TO NOTICE TO FILE CORRECTED APPLICATION PAPERS

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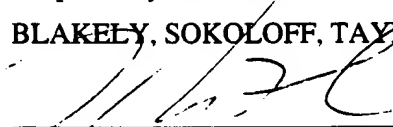
In response to the Notice to File Corrected Application Papers mailed March 5, 2001, Applicant has enclosed a new set of drawings. Please find enclosed four (4) sheets of drawings.

If any additional fee is required, please charge Deposit Account No. 02-2666. A duplicate of this Response is enclosed.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN

Dated: March 26, 2001


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Reg. No. 41,402

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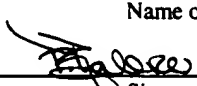
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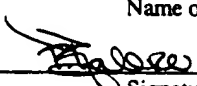
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APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
09/755,483	01/05/2001	Deyang Song	5416P001

CONFIRMATION NO. 5096

FORMALITIES LETTER



OC000000005822749

Tarek N. Fahmi
BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP
7th Floor
12400 Wilshire Boulevard
Los Angeles, CA 90025

Date Mailed: 03/05/2001

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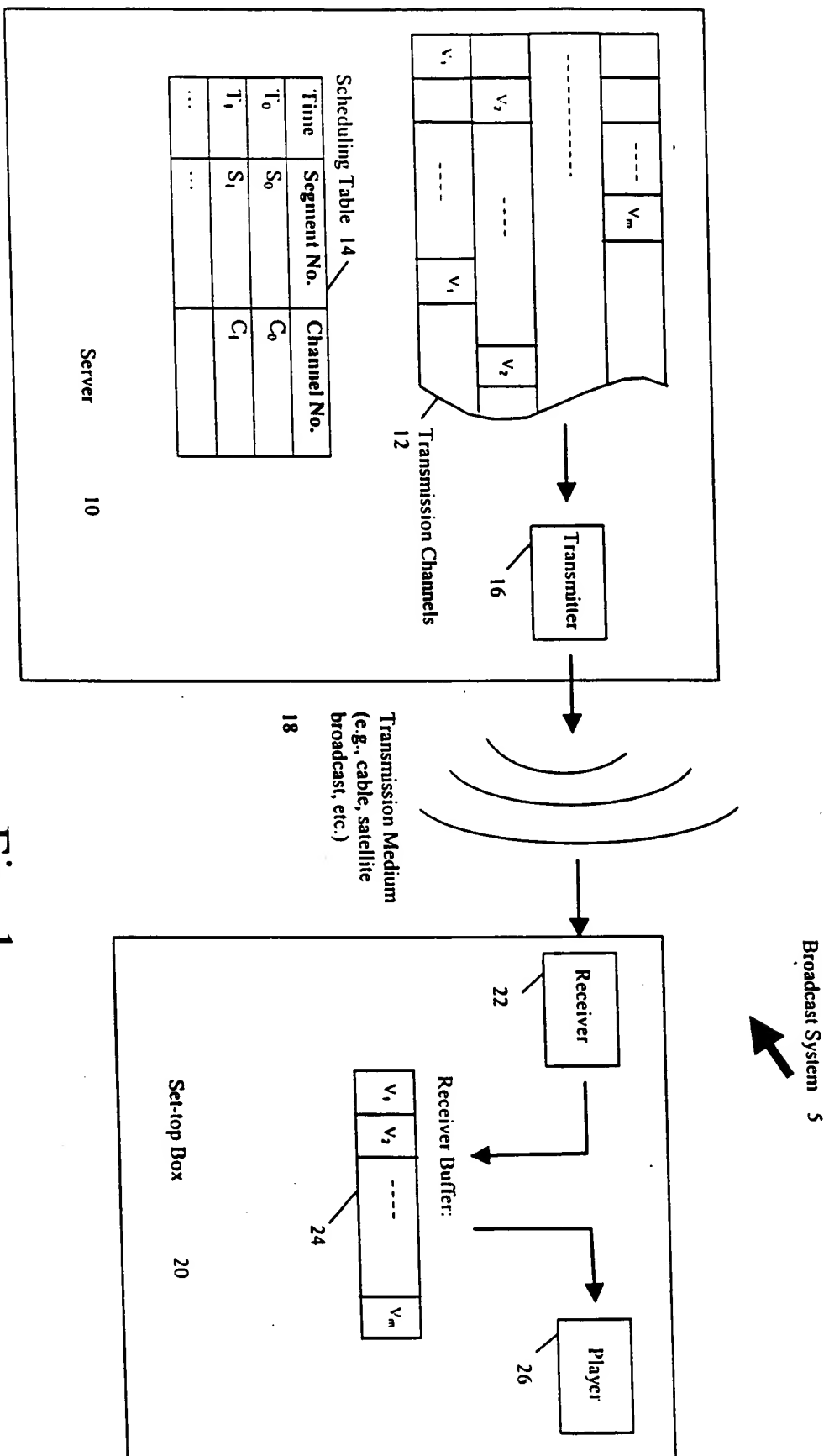


Fig. 1

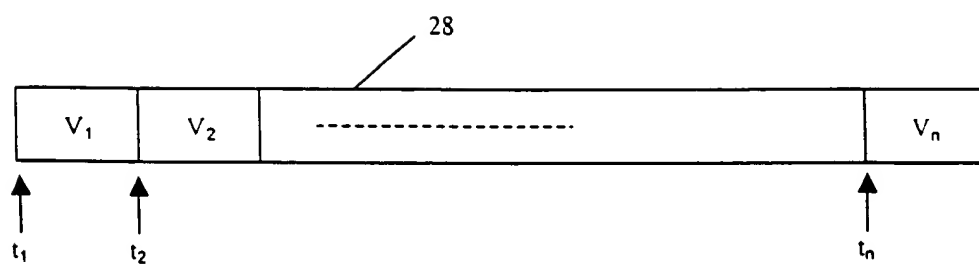


Fig. 2

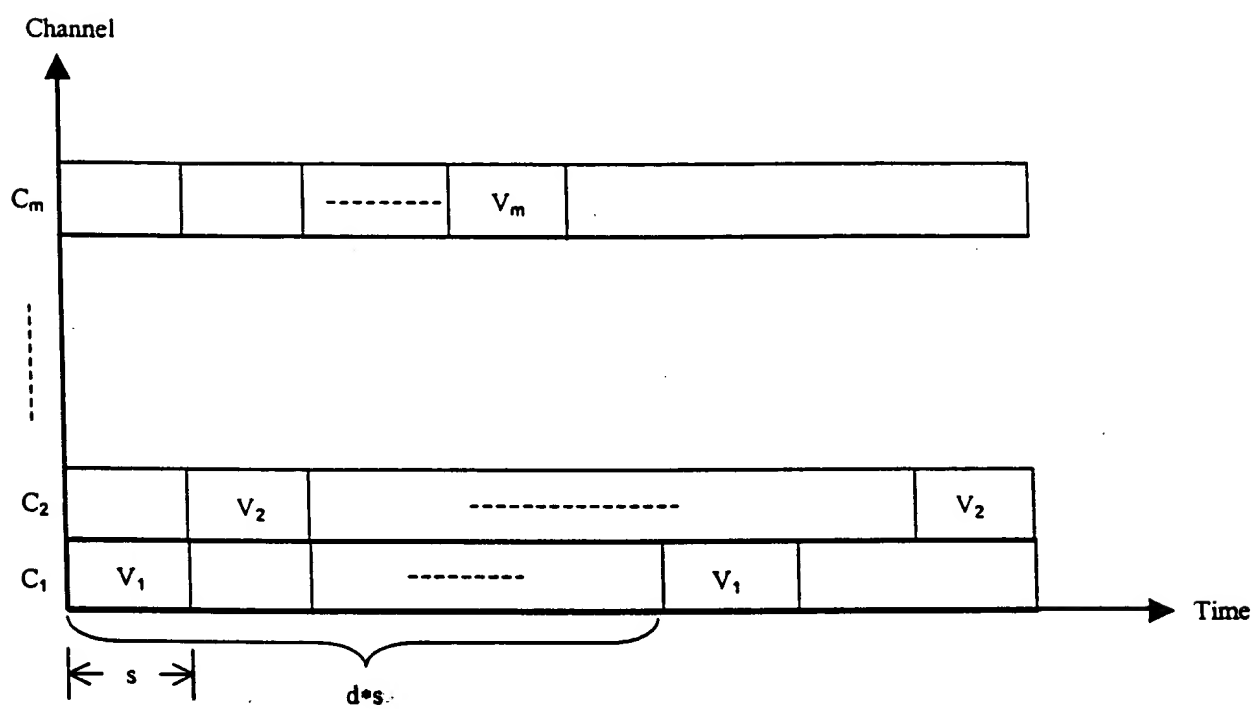


Fig. 3

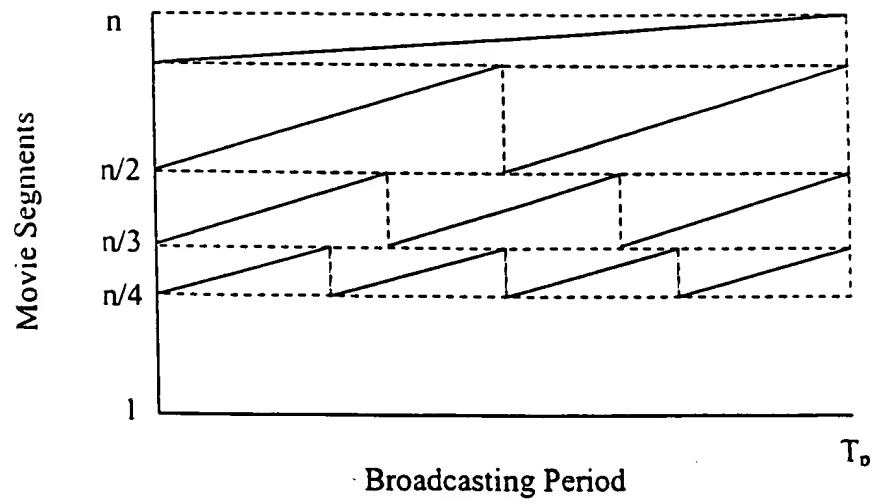


Fig. 4

q	k	i
1	$\left\lceil \frac{T_p}{t_1 + t_d} \right\rceil$	$n_0 (=0), n_1 (=1)$
2	$\left\lceil \frac{T_p}{t_2 + t_d} \right\rceil$	$n_1 + 1, n_2 (=2)$
...
Q-1	2	$n_{Q-2} + 1 \dots n_{Q-1}$
Q	1	$n_{Q-1} + 1 \dots n_Q$

Fig. 5

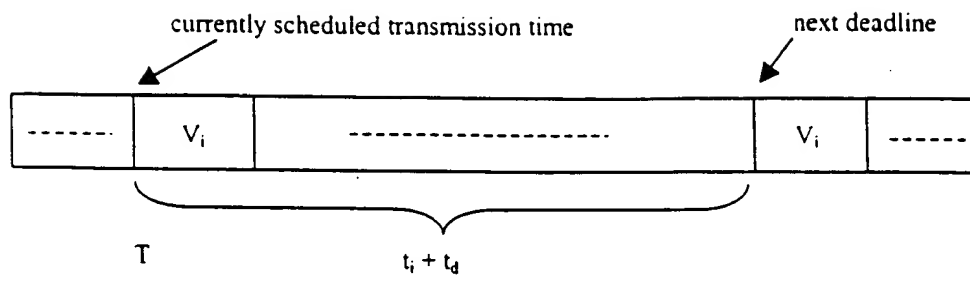


Fig. 6

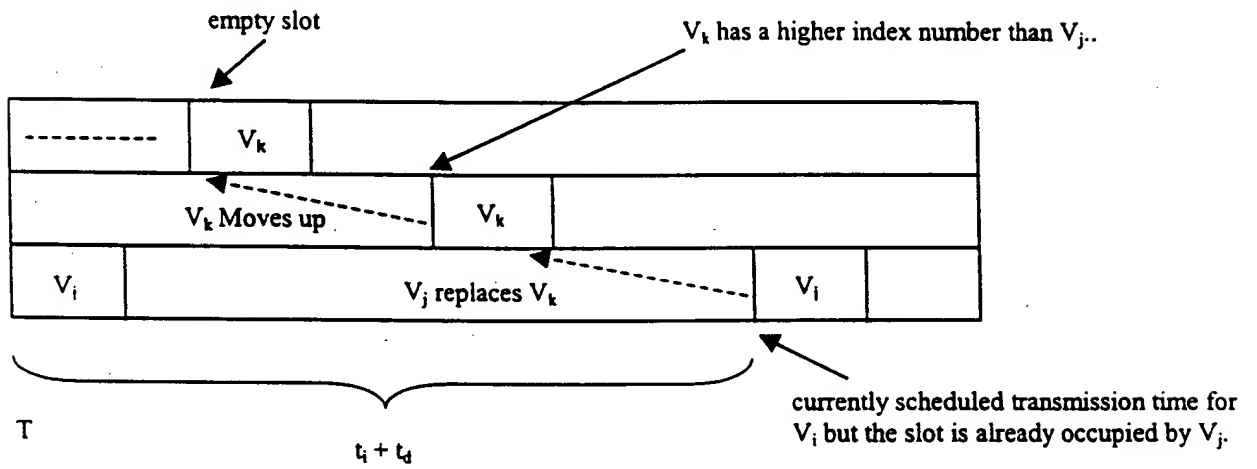


Fig. 7



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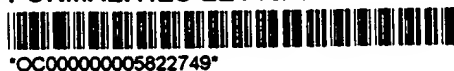
APPLICATION NUMBER	FILING/RECEIVED DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
09/755,483	01/05/2001	Dayang Song & Sitoum Liang Dayang Song	5416P001

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CONFIRMATION NO. 5096

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 Los Angeles, CA 90025

 BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN
 LOS ANGELES


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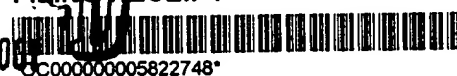
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APPLICATION NUMBER	FILING DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	DRAWINGS	TOT CLAIMS	IND CLAIMS
09/755,483	01/05/2001	2643	530	5416P001	4	35	4

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7th Floor
12400 Wilshire Boulevard
Los Angeles, CA 90025

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Date Mailed: 03/05/2001

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Applicant(s)

Deyang Song, Belmont, CA;
Shoudan Liang, Palo Alto, CA;

ENTERED
MAR 13 2001
STATUS DB-LA

Continuing Data as Claimed by Applicant

THIS APPLN CLAIMS BENEFIT OF 60/175,166 01/07/2000

Foreign Applications

If Required, Foreign Filing License Granted 03/02/2001

Projected Publication Date: Request for Non-Publication Acknowledged

Non-Publication Request: Yes

Early Publication Request: No

** SMALL ENTITY **

Title

Method for digital media playback in a broadcast network

Preliminary Class

348

Data entry by : WODAJE, ELENI

T am : OIPE

Date: 03/05/2001



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Serial/Patent No.: ***** Filing/Issue Date: Herewith
Client: DEYANG SONG & SHOUDAN LIANG
Title: METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK

BSTZ file No.: 5416P001 Atty/Secty Initials: TNF/pab
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Due date 4/5/2001 Client Name Deyang Song & Shoudan Liang
Docket Initial AV 5416 . P001
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Pat/Ser/Reg 755,483 19

Description

3 month deadline to file prior art disclosure and check related cases
(based on filed US application).

1/22/2001

Linda Montes

Due date 10/5/2001 Client Name Deyang Song & Shoudan Liang
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Pat/Ser/Reg 755,483 21

Description

3 months remaining to F/F

Due date 7/5/2001 Client Name Deyang Song & Shoudan Liang
Docket Initial AV 5416 . P001
Dock. Sup. Initial AV
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Pat/Ser/Reg 755,483 20

Description

F/F letter

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Due date 1/5/2002 Client Name Deyang Song & Shoudan Liang
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Description

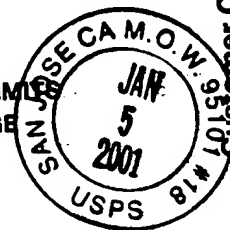
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Client: DEYANG SONG & SHOUDAN LIANG
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Inventors: Deyang Song et al.
Filing Date: Herewith
Express Mail No.: EL672752862US

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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No. 5416P001

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First Named Inventor Deyang Song

Title: METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK

Express Mail Label No. EL672752862US

ADDRESS TO: Assistant Commissioner for Patents
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Washington, D. C. 20231

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. x Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original, and a duplicate for fee processing)
2. x Applicant Claims Small Entity Status. (37 CFR 1.27)
3. x Specification (Total Pages 36)
(preferred arrangement set forth below)
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 - Statement Regarding Fed sponsored R & D
 - Reference sequence listing, a table,
or a computer program listing appendix
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 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
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 - Claim(s)
 - Abstract of the Disclosure
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 - c. Unsigned.
6. Application Data Sheet. (37 CFR 1.76)
7. CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix)
8. Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
 - a. Computer Readable Form (CRF)
 - b. Specification Sequence Listing on:
 - i. CD-ROM or CD-R (2 copies); or
 - ii. paper
 - c. Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

9. ☐ Assignment Papers (cover sheet & documents(s))
10. ☐ a. Separate 37 CFR 3.73(b) Statement (where there is an assignee)
- ☒ b. Power of Attorney
11. ☐ English Translation Document (if applicable)
12. ☒ a. Information Disclosure Statement (IDS)/PTO-1449
- ☒ b. Copies of IDS Citations
13. ☐ Preliminary Amendment
14. ☒ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)
16. ☒ Request and Certification under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or its equivalent.
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18A. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP)
Of Prior Application No.: ☐ Examiner ☐ Group Art Unit ☐

(which is a ☐ continuation/ ☐ divisional/ ☐ CIP of prior application no. ☐
which is a ☐ continuation/ ☐ divisional/ ☐ CIP of prior application no. ☐ (List entire chain of priority)

For CONTINUATION AND DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 5b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

18B. Statement under 37 CFR 3.73(b) for continuing application:

The undersigned states that ☐ (name of assignee) is the assignee of the entire right, title, and interest in the accompanying patent application by virtue of an assignment recorded in the Patent and Trademark Office at Reel No. ☐ Frame No. ☐ (or a copy of which is attached).

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CITY Los Angeles STATE California ZIP CODE 90025-1026

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Name (PRINT/TYPE): Tarek N. Fahmi Registration No.: 41,402

Signature: [Signature] Date: 11/5/2001

REQUEST AND CERTIFICATION UNDER 35 U.S.C. 122(b)(2)(B)(i)First Named Inventor Deyang SongTitle METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORKAttorney Docket No. 5416P001

I hereby certify that the invention disclosed in the attached application **has not and will not be** the subject of an application filed in another country, or under a multilateral agreement, that requires publication at eighteen months after filing. I hereby request that the attached application not be published under 35 U.S.C. 122(b).

Jan. 5/2001
Date

[Signature]
Signature

Tarek N. Fahmi

Typed or Printed Name

41,402

Registration No.

This request must be signed in compliance with 37 CFR 1.33(b) and submitted with the application upon filing.

Applicant may rescind this nonpublication request at any time. If applicant rescinds a request that an application not be published under 35 U.S.C. 122(b), the application will be scheduled for publication at eighteen months after the earliest claimed filing date for which a benefit is claimed.

If applicant subsequently files an application directed to the invention disclosed in the attached application in another country, or under a multilateral international agreement, that requires publication of applications eighteen months after filing, the applicant **must** notify the United States Patent and Trademark Office of such filing within forty-five (45) days after the date of filing of such foreign or international application. **Failure to do so will result in abandonment of this application (35 U.S.C. 122(b)(2)(B)(iii)).**

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FEE CALCULATION (continued)**3. ADDITIONAL FEES**

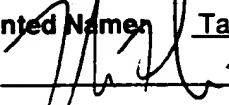
<u>Large Entity</u>		<u>Small Entity</u>		<u>Fee Description</u>	<u>Fee Paid</u>
<u>Fe</u>	<u>Fe</u>	<u>Fe</u>	<u>Fee</u>		
<u>Code</u>	<u>(\$)</u>	<u>Code</u>	<u>(\$)</u>		
105	130	205	65	Surcharge - late filing fee or oath	_____
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	_____
139	130	139	130	Non-English specification	_____
147	2,520	147	2,520	For filing a request for ex parte reexamination	_____
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	_____
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	_____
115	110	215	55	Extension for reply within first month	_____
116	390	216	195	Extension for reply within second month	_____
117	890	217	445	Extension for reply within third month	_____
118	1,390	218	695	Extension for reply within fourth month	_____
128	1,890	228	945	Extension for reply within fifth month	_____
119	310	219	155	Notice of Appeal	_____
120	310	220	155	Filing a brief in support of an appeal	_____
121	270	221	135	Request for oral hearing	_____
138	1,510	138	1,510	Petition to institute a public use proceeding	_____
140	110	240	55	Petition to revive - unavoidable	_____
141	1,240	241	620	Petition to revive - unintentional	_____
142	1,240	242	620	Utility issue fee (or reissue)	_____
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122	130	122	130	Petitions to the Commissioner	_____
123	130	123	130	Petitions related to provisional applications	_____
126	180	126	180	Submission of Information Disclosure Stmt	_____
581	40	581	40	Recording each patent assignment per property (times number of properties)	_____
146	710	246	355	For filing a submission after final rejection (see 37 CFR 1.129(a))	_____
149	710	249	355	For each additional invention to be examined (see 37 CFR 1.129(b))	_____
179	710	279	355	Request for Continued Examination (RCE)	_____
169	900	169	900	Request for expedited examination of a design application	_____
Other fee (specify) _____					_____
Other fee (specify) _____					_____

SUBTOTAL (3) \$ 0.00

*Reduced by Basic Filing Fee Paid

SUBMITTED BY:

Typed or Printed Name: Tarek N. Fahmi

Signature:  Date: 11/5/2001

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FEE TRANSMITTAL FOR FY 2001TOTAL AMOUNT OF PAYMENT (\$) \$512.00

Complete if Known:

Application No. Not Yet AssignedFiling Date HerewithFirst Named Inventor Deyang SongGroup Art Unit Not Yet AssignedExaminer Name Not Yet AssignedAttorney Docket No. 5416P001**METHOD OF PAYMENT (check one)**

1. ☒ The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

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 Deposit Account Name _____

☒ Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17

☒ Applicant claims small entity status. See 37 CFR 1.27

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FEE CALCULATION**1. BASIC FILING FEE**

Large Entity		Small Entity		Fee Description	Fee Paid
Fee Code	Fee (\$)	Fee Code	Fee (\$)		
101	710	201	355	Utility application filing fee	<u>\$355</u>
106	320	206	160	Design application filing fee	_____
107	490	207	245	Plant filing fee	_____
108	710	208	355	Reissue filing fee	_____
114	150	214	75	Provisional application filing fee	_____

SUBTOTAL (1) \$ 355.00**2. EXTRA CLAIM FEES**

		Extra Claims		Fee from below		Fee Paid	
Total Claims	<u>33</u>	- 20** =	<u>13</u>	X	<u>\$ 9</u>	=	<u>\$117</u>
Independent Claims	<u>4</u>	- 3** =	<u>1</u>	X	<u>\$40</u>	=	<u>\$ 40</u>
Multiple Dependent						=	

**Or number previously paid, if greater; For Reissues, see below.

Large Entity		Small Entity		Fee Description
Fee Code	Fee (\$)	Fee Code	Fee (\$)	
103	18	203	9	Claims in excess of 20
102	80	202	40	Independent claims in excess of 3
104	270	204	135	Multiple dependent claim, if not paid
109	80	209	40	**Reissue independent claims over original patent
110	18	210	9	**Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) \$ 157.00

FEE CALCULATION (continued)**3. ADDITIONAL FEES**

<u>Large Entity</u>		<u>Small Entity</u>		<u>Fee Description</u>	<u>Fee Paid</u>
<u>Fee</u>	<u>Fee</u>	<u>Fee</u>	<u>Fee</u>		
<u>Code</u>	<u>(\$)</u>	<u>Code</u>	<u>(\$)</u>		
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	
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146	710	246	355	For filing a submission after final rejection (see 37 CFR 1.129(a))	
149	710	249	355	For each additional invention to be examined (see 37 CFR 1.129(b))	
179	710	279	355	Request for Continued Examination (RCE)	
169	900	169	900	Request for expedited examination of a design application	
Other fee (specify) _____					
Other fee (specify) _____					

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SUBMITTED BY:

Typed or Printed Name: Tarek N. Fahmi

Signature: [Signature] Date: 1/5/2001

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Serial/Patent No.: **** Filing/Issue Date: Herewith
Client: DEYANG SONG & SHOUDAN LIANG
Title: METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK

BSTZ File No.: 5416P001 Atty/Secty Initials: TNF/pab
Date Mailed: 1/5/01 Docket Due Date: _____

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| <input type="checkbox"/> Appeal Brief (____ pgs.) (in triplicate) | <input type="checkbox"/> _____ Month(s) Extension of Time | Am: <u>\$512.00</u> |
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United States Patent Application

For

METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK

Inventors:

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Patricia A. Balero

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METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK

RELATED APPLICATION

The present application is related to and hereby claims the priority benefit of a United
5 States Provisional Patent Application No. 60/175,166, entitled "Instant Digital Media
Playback in a Broadcast Network," filed January 7, 2000, by Deyang Song and Shoudan
Liang.

FIELD OF THE INVENTION

10 The present invention relates to the field of digital broadcast networks such as digital
cable television systems, digital terrestrial broadcast systems and/or digital satellite systems,
and in particular to video-on-demand (VoD) broadcast systems, such as may be found in
cable or satellite television broadcast systems and/or computer networks or networks of
networks.

15

BACKGROUND

For several years, operators of cable and satellite television broadcast systems (and
more recently long distance network operators) have been promoting so-called video-on-
demand (VoD) systems. In theory, these systems will allow end-users to request virtually any
20 movie or other audio-video program from a library and have that movie or other presentation
begin playback almost immediately. To date, however, the promise of such near-
instantaneous playback has gone unrealized and, perhaps as a result, VoD systems have not
yet been widely deployed.

Current VoD systems operate on familiar client-server principles. Movies and other audio-video programs are stored at one or more central locations (e.g., a cable or satellite television head-end system) and are played out as requested to one or more client devices (e.g., cable or satellite television receivers commonly called "set-top boxes"). Requests for movies may be made in various fashions, such as by utilizing a back channel between the client and the server across the transmission medium or through a separate channel such as a dial-up telephone connection. Upon receipt of a request for a program, the server typically opens a separate video stream to serve the new request. Thus, as more requests are received, more video streams are opened, up to a point.

One of the problems of current VoD systems that prevent such systems from being widely deployed is the scalability of the servers involved in such systems. Currently, each server can only support a predetermined number of viewers requesting on-demand movies. Because of these limitations, if additional requests for videos are received while the server is serving a maximum number of current viewers, the server is forced to reject the new requests, leaving the video consumers unsatisfied. For example, if the server is designed to support 1000 concurrent video streams, the 1001th request (and all those thereafter) will be rejected or at the very least delayed until one of the current viewers finishes his/her session.

This limitation on the number of streams that any one server can source is due, in part, to bandwidth constraints. At the server, movies are often stored as computer-readable files on hard disks, or other computer-readable media, in the well-known MPEG-2 format (Motion Picture Experts Group-2) or other format. During transmission, each MPEG-2 movie typically consumes a bandwidth ranging from 3 - 6 Mbps, depending upon the video quality, etc. Existing digital broadcast networks, however, typically utilize analog transmission channels. Take the digital cable network in the United States for example; each

analog transmission channel occupies 6 MHz of radio frequency spectrum. Broadcast networks are required to divide up these available analog channels into segments in order to accommodate the transmission of digital movies. Depending on the modulation scheme, one 6 MHz analog channel can carry digital movies totaling 27 Mbps and up. If each movie is
5 encoded at 4 Mbps, then each analog channel can carry at least 6 digital channels.

Given the limited amount of bandwidth to transmit digital movies, a VoD server can only serve a limited number of concurrent viewers using the traditional approach of one-stream-per-viewer. Using the above example, suppose each analog channel carries 6 digital channels, a conventional 100-channel cable system can thus only serve 600 viewers
10 simultaneously. In order to serve a large number of home viewers then, a cable service provider would be forced to replicate the servers and the various movies many times over. This has been, to date, economically unfeasible and so VoD systems have not been deployed. Thus, an alternative scheme for VoD systems is needed.

15

SUMMARY OF THE INVENTION

In one embodiment, a schedule for transmission times of various segments of digital content is computed to allow for transmission of these segments across multiple channels so as to permit any number of content consumers to begin playback of said segments of digital content from an origination point thereof within a waiting time of a request (the waiting time may be selectable by the content broadcaster) for such playback. These various segments of digital content together may make up a movie. These segments are preferably non-overlapping, and each of their sizes can be arbitrary, although quite often they are made equal length in time.

In some cases, the schedule is determined according to an earliest-deadline-first (EDF) process. In the EDF process, a next transmission time for a segment of digital content is determined by first finding an earliest deadline amongst a list of current deadlines for each of the various segments and selecting this segment for transmission. The earliest deadline so chosen may be verified to be later than a finishing time for a last transmitted segment. A new deadline for transmission of the selected segment may then be determined according to $T + t_i + t_d$, where T is a beginning time for the transmission of the selected segment, t_i is the playback time of segment i in the movie, and t_d is the waiting time at the receivers.

In other cases, the schedule may be determined according to a just-in-time (JIT) process. The JIT process schedules each of the various segments for transmission as close to a transmission deadline associated with each segment as possible. In the JIT process, conflicts for transmissions over the multiple channels are resolved by scheduling a segment with an earlier playback time closer to its deadline for transmission than a segment with a later playback time. Segments with later playback times may be rescheduled earlier in order to avoid conflict.

In still further cases, the schedule may be determined according to a periodic transmission process. Such a process allows a broadcast schedule for the movie to be repeated every period time, the period time being equal to an integral multiple of a length of the movie. In this scheme, each one of the multiple segments is allocated to a transmission queue of a transmission schedule table according to a number of times equal to the period time divided by the sum of the waiting time and a playback time for such segment.

A further embodiment provides a procedure wherein a multimedia presentation is first divided into sequential segments, each segment having a time length, the transmission of the segments of the multimedia presentation is then scheduled according to a specified delay time that does not depend on the time lengths of the segments, and the segments are then transmitted over a broadcast network according to the schedule for each segment so computed. Preferably, a transmission bandwidth of multiple times that of the multimedia presentation is allocated for transmission of the segments and each segment is then transmitted repeatedly based on the computed schedule. Once transmitted, the segments may be received and stored in temporary storage, and then played back as soon as the delay time has elapsed.

Each of the segments may be scheduled for repeated transmissions at periodic times. These periodic times for transmission of each respective segment may equal time offsets of the beginning of such respective segments plus an operator selected delay time. Segments having earlier transmission deadlines should be scheduled first and as soon as possible.

Alternatively, the segments may be transmitted just-in-time as determined by respective time offsets and the specified delay. In the case of a conflict where more of the segments are to be transmitted than allocated bandwidth allows, segments later in the presentation are scheduled to be transmitted earlier in nearest empty time slots, giving

priority to earlier segments to be transmitted as closely as possible to their scheduled time slots. In some cases, an overlap period between an end of a current presentation and a beginning of a next presentation may also be computed, to minimize interruptions therebetween.

5 Still another embodiment provides a server configured to generate transmission schedules for each of a number of segments of a multimedia presentation to be transmitted over a multiple channels of a broadcast network, the schedules being computed according to a specified delay time that does not depend on time lengths of the segments. The transmission schedules are preferably computed according to one of a just-in-time
10 transmission (JIT) procedure, an earliest-deadline-first (EDF) procedure, a hybrid of the EDT and JIT procedures, or a periodic transmission procedure. For the EDF procedure a next segment to be transmitted is determined by first finding an earliest transmission deadline amongst a list of current transmission deadlines for each of the segments and selecting this segment for transmission. For the JIT procedure each of the segments is scheduled for
15 transmission as close to a transmission deadline associated with each segment as possible. For the hybrid procedure segments with the earliest deadlines are transmitted first, but the deadlines for each of the segments are computed conflict-free with the JIT procedure. For the periodic transmission procedure each of the segments is allocated to a transmission queue according to a schedule that takes into account a period of the presentation, the delay time
20 and a playback time for each segment.

Yet another embodiment provides a receiver configured to receive segments of multimedia presentation from multiple transmission channels simultaneously and to begin playback of the segments in a sequence corresponding to a proper format for the multimedia presentation after a predetermined delay time that is independent of time lengths of the

segments. The segments may be stored on a local storage medium and may be received according to a schedule that was computed according to one of a just-in-time transmission (JIT) procedure, an earliest-deadline-first (EDF) procedure, a combination thereof or a periodic transmission procedure.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is illustrated by way of example, and not limitation, in the figures of the accompanying drawings in which like reference numerals refer to similar elements and in which:

5 **Figure 1** is a schematic illustration of a digital broadcast system configured in accordance with an embodiment of the present invention.

Figure 2 is a schematic illustration of a conventional method of dividing a multimedia presentation into non-overlapping segments.

10 **Figure 3** is a schematic illustration of the scheduled transmission of segments of a multimedia presentation in accordance with an embodiment of the present invention.

Figure 4 is a schematic illustration of an embodiment of a periodic scheduling algorithm in accordance with an embodiment of the present invention.

Figure 5 is a schematic illustration of queues that contain the segment indexes used in a periodic transmission scheme in accordance with an embodiment of the present invention.

15 **Figure 6** is a schematic illustration of how the next deadline for V_i is computed in the Earliest-Deadline-First (EDF) scheduling algorithm in accordance with an embodiment of the present invention.

Figure 7 is a schematic illustration of how scheduling conflicts are resolved in the Just-In-Time scheduling algorithm in accordance with an embodiment of the present invention.

20

DETAILED DESCRIPTION

Described herein is a scheme in which a multimedia presentation (e.g., a digital movie) is divided into small segments and those segments are broadcast periodically using multiple channels following a pre-computed schedule. Such a scheme may find application, for example, in a broadcast system for cable television or a satellite television broadcast system. Other areas where the present invention may find application include computer networks or networks of networks, such as the Internet or any other area where audio-video presentations are intended for “on-demand” style presentation.

The present scheme exploits the idea that many viewers may wish to view the same movie or other content, but at different times. For example, it is likely that many viewers will wish to view so-called “first run” movies or other popular content, but that they will want to schedule such viewings at individual times convenient for themselves. Thus, when serving a large number of viewers, a VoD server is, at any particular time, very likely to be serving the same movie to many viewers who started the playback at different times.

By exploiting this idea, the present method allows all the viewers watching the same movie to use a fixed amount of the available bandwidth for the broadcast system (usually just a few multiples of the bandwidth required for one movie). This helps to “scale up” VoD servers in large-scale deployments. That is, by eliminating the necessity for the server to consume the same bandwidth for each instance of a movie or other content being broadcast in response to a client request, the present method allows broadcasters to free up this bandwidth for other uses (e.g., additional requests for content).

In addition to allowing for greater economies of scale, the present scheme provides for near-instantaneous playback of requested movies or other content. That is, a client (e.g., a digital set-top-box with a certain amount of local storage capacity in the form of a computer-

readable/writeable medium, preferably of up to one movie length), when tuning to a selected presentation will be able to play back that presentation from its beginning after a very short waiting time. The waiting time is adjustable and it is expected to range from 1 to 30 seconds, depending on the number channels allocated to a particular presentation. In one embodiment, where 6 MPEG-2 channels are allocated for each movie, a user can tune in to a movie at any time and need only wait a maximum of approximately 30 seconds for the movie to begin playing from its beginning.

Although discussed with reference to certain illustrated embodiments, upon review of this specification, those of ordinary skill in the art will recognize that the present scheme for VoD broadcast and/or digital broadcast networks may find application in a variety of systems. Therefore, in the following description the illustrated embodiments should be regarded as exemplary only and should not be deemed to be limiting in scope. Instead, the reader is directed to the claims at the end of this specification, which claims more clearly define the present invention. Further, some portions of the detailed description that follows are presented in terms of algorithms and symbolic representations of operations on data within a computer memory. These algorithmic descriptions and representations are the means used by those skilled in the computer science arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers or the like. It should be borne in mind,

however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities.

The symbols used in the algorithms presented herein have the following meanings:

5	B	data-rate of one movie
	C_k	channel k
	d	delay factor
	D[i]	the next deadline for the i-th segment
	δ_i	the transmission time of the i-th segment
10	i	segment index
	k	channel index
	L[i]	the proposed (future) schedule time for segment i.
	m	# of channels
	n	# of segments
15	s_i	the i-th segment length (in time)
	S[]	the scheduling table
	t_i	playback time for the i-th segment
	t_d	the operator-selected maximum wait-time by the receiver
	T_p	the schedule period
20	V_i	the i-th segment

Further, unless specifically stated otherwise, it should be appreciated that throughout the description of the present invention, use of terms such as "processing", "computing", "calculating", "determining", "displaying" or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

As indicated above, the present method allows for a potentially unlimited number of viewers to watch the same multimedia presentation transmitted over a digital broadcast network with a fixed amount of bandwidth allocation. Under the present scheme, each digital

multimedia presentation (e.g., a movie or the like) is divided into segments of equal playback time or equal compressed transmission time. (In fact, the present methods will schedule any arbitrary division of a movie.) The total bandwidth allocated for the transmission of the multimedia presentation is divided into multiple channels, each of which having the
5 bandwidth equal that of the multimedia presentation. A time-based schedule (which may be realized in a scheduling table stored as a computer-readable file at the server) is computed based on the total bandwidth allocated for the transmission and the segments of the presentations are then transmitted repeatedly in different channels according to the respective computed schedule. The frequency of their transmission, however, is different based on their
10 relative location to the beginning of the presentation. The transmitted segments are first buffered and then reassembled by the receiver, preferably within a predetermined period of time. In practice, the receiver should be able to receive data from the multiple channels allocated to the broadcast of the rearranged segments of the multimedia presentation. This is feasible using transmission and reception hardware found in existing digital cable networks
15 and direct broadcast satellite systems.

The present invention may be embodied in a system that includes a broadcast server that transmits the segments of a digital video according to the computed schedule, and a broadcast receiver that receives the transmitted segments and reassembles them into the original video. The receiver is assumed to have sufficient available temporary storage to
20 buffer a number of segments of the movie, sufficient to permit the required reassembling. One embodiment of the present invention involves a software implementation of the above-described method, which implementation is independent of the particular hardware used in the broadcast network and/or the transmission system employed therein.

Figure 1 schematically illustrates a broadcast system implementing one embodiment of the current invention. Broadcast system 5 includes a server 10 and a set-top box (or other form of receiving client) 20. It should be appreciated that set-top box 20 is merely one example of a number of receiving clients that may be part of broadcast system 5. It is expected that there may be hundreds or thousands (or more) of such receiving clients that together comprise a cable or satellite television distribution system. A single set-top box 20 is shown here merely for purposes of illustrating the systems and methods of the present invention and should not be deemed to limit the broader applicability of the present invention to much larger distribution systems. Not shown here is the Electronic Program Guide (EPG) that every set-to-box receives that provides, among other things, the mapping of movies to channels. Also not shown in the diagram is a back channel or other communication channel that may exist between the set-top box 20 and the server 10, which back channel may be used to communicate requests for on-demand movies, as an alternative for server-initiated broadcasting. Such back channels are well-known in the art and need not be described in detail herein.

The broadcast server 10 stores a number of movies and other audio-video presentations on local storage (not shown). For example, the server 10 may store such movies on a local hard drive or, more commonly, on a local series of storage media accessible as needed. These details are well-known in the art and need not be described further herein in order no to obscure the details of the present invention.

Server 10 transmits segments of a video or other presentation in channels 12 based on a computed schedule stored in a scheduling table 14. The diagram illustrates the idea of parsing up a presentation into a number of segments and then transmitting these segments in various time slots of a number of digital channels 12. The digital channels 12 may each be

sub-channels of a wider analog channel as discussed above. Such multiplexing of digital content into sub-channels of an analog channel is also well-known in the art and may be performed in a modulator stage of a broadcast system and/or in the transmitter stage.

The transmitter 16 shown in the drawing need not necessarily be a separate component of broadcast system 5 or server 10 and is shown in block diagram form to represent a set of hardware and/or software components configured to transmit the segments of the presentation across the transmission medium 18 (which may be conventional cable television transmission media, satellite transmission media and/or a combination of these media types).

In some cases, the transmitter 16 may be implemented as a network interface card and a router in a data network, or a multiplexer, modulator and radio frequency (RF) transmitter. The transmission medium 18 may represent a data or other computer network or network of networks (such as the Internet), a digital cable network, or a Direct Broadcast Satellite (DBS) system. In short, the present invention may be utilized with any existing broadcast system configured to transport multimedia segments over multiple transmission channels.

Set-top box 20 is configured to receive the segments broadcast over transmission medium 18 and also to reassemble those segments into a proper form for playback. The set-top box 20 is shown as including a receiver 22, a receive buffer 24 and a player 26. In some embodiments, one or more of these components may be external to the set-top box 20. For example, player 26 may be incorporated in a television set or other playback device and/or in an external tuner or other module associated therewith. Receive buffer 24 may be a separate computer-readable medium, such as an external hard drive or the like, or may be included as a component of receiver 22 or player 26. In some cases, the receive buffer 24 may even be distributed between player 26 and receiver 22. Receiver 22 is configured to allow for user

selection of a channel, i.e., one of the analog channels over which broadcast server 10 transmits. Receiver 22 receives data from the transmission medium 18 and saves the received data (one segment at a time) to receive buffer 24. Thereafter, player 26 may play back the stored segments, in sequence and perhaps at a specific time, for the user. Often, there will be some delay between reception of the segments and storage thereof at receive buffer 24 and playback through player 26. This delay time, which in some cases can be set by the user and/or the broadcast network operator, allows for proper sequencing of the segments and also guards against poor quality playback which may result from buffer underflows due to transmission errors.

Having thus presented the overall system within which the methods of the present invention operate, further details of the scheduling algorithms used to produce scheduling table 14 may be described. To understand the development of these algorithms, however, some further analysis of bandwidth requirements for the transmission of movies and other presentations is helpful.

The Analysis of Bandwidth Requirements

In conventional digital broadcast networks, such as cable, DBS, or High-Definition Television (HDTV) systems, multimedia presentations are often encoded, stored and transmitted as encoded digital video files. These files typically contain time-stamped, frame-by-frame compressed video and audio segments (sometimes called packets). Finding a particular segment then often involves searching for a time-stamp having the approximate desired time value (this is modified somewhat by the need in MPEG systems to also find the key frames that allow for reconstruction of a desired frame).

As shown in **Figure 2**, a digital video file 28 of h hours at a data rate of B (bits/second) is divided into n segments, V_i , $i=1, 2, \dots, n$. Each segment contains “ s ” seconds of video data, where:

$$s = \frac{3600h}{n} \quad (1)$$

Now, in accordance with the present scheme, each segment V_i is broadcast repeatedly every $(d+i-1)*s$ seconds, where d is a delay factor. These segments are broadcast using m channels, each channel having a bandwidth of B . The m channels may each be digital sub-channels of an analog channel. This broadcasting scheme is illustrated in **Figure 3**.

If a receiver (e.g., receiver 22 in set-top box 20 of **Figure 1**) can receive data from the m channels simultaneously, and it has access to local storage (e.g., receive buffer 24) that can store at least h hours of video, it can implement the VoD function with at most $t_d = d*s$ seconds delay. In a digital broadband network, the m channels are equivalent to 1 channel with a total bandwidth of $m*B$. Thus, one needs to derive the smallest m required to support this scheme.

The bandwidth required to broadcast a segment V_i is:

$$b_i = \frac{1}{d+i-1} B \quad (2)$$

Thus, the total bandwidth required to support an entire movie is:

$$b_{tot} = \sum_{i=1}^n b_i = B \sum_{i=1}^n \frac{1}{d+i-1} \quad (3)$$

An approximation for equation (3) is

$$b_{tot} \approx B \int_0^n \frac{dx}{d+x} = B [\ln(d+n) - \ln(d)] \quad (4)$$

And m can then be calculated as following:

$$m = \left\lceil \frac{b_{tot}}{B} \right\rceil \approx \lceil \ln(d + n) - \ln(d) \rceil \quad (5)$$

For example, for a 2 hour movie divided into 5-second segments, $n = 1440$. If the maximum delay time for beginning playback after a request has been made is to be 30 seconds, then $d = 6$. Suppose the video data rate is 4 Mbps, then the total bandwidth required is $b_{tot} \approx 22$ Mbps. This will take, at most, 6 channels ($m = 6$).

Note that in the above analysis, we assume that each movie segment is of equal length in time. If each segment has a different length s_i , equation (2) would become:

$$b_i = \frac{s_i}{t_i + t_d} B \quad (6)$$

And the bandwidth requirement m can be similarly derived.

10 We describe below three different algorithms for broadcasting a movie over m channels repetitively.

The Earliest-Deadline-First Transmission Algorithm:

15 In this scheme, the i -th segment, at playback time t_i , has a transmission time δ_i , which time depends on the movie and varies with the segments. Therefore, scheduling needs to be done on a case-by-case basis. An adjustable wait (or delay) time can optimally absorb any extra bandwidth turning it into a valuable resource. We seek the optimal wait time given a fixed number of channels.

20 A viewer tuned in at time t generates n deadline demands for each of the n segments. On the broadcast server side, the deadline is defined as the time by which the segment must

repeat itself. The segment V_i has to be broadcast before $t + t_i + t_d$, where t_i is the playback time of segment i in the movie (see **Figure 2**), and t_d is the waiting time by the receivers. This deadline definition is the same throughout all the scheduling algorithms presented herein, and is illustrated graphically in **Figure 6**. We then seek a feasible broadcast schedule
5 that meets the deadlines for any of the n segments V_i for any connect time (i.e., the time at which a new user demands playback).

The available resources are time slots on the broadcasting channels. The present scheduling algorithm decides which of the n segments should be broadcast in the next available time slot/channel. For this earliest deadline first (EDF) policy, the segment V_i
10 having the shortest of the n deadlines is broadcast next. To accommodate such scheduling, one intermediate array is needed--the list of the earliest deadlines for each of the n segments, $D[i]$. We describe how to determine the optimal wait time and the algorithm also determines whether the wait time is feasible.

According to the present method, the video segment V_i having the earliest deadline is
15 scheduled to be transmitted next in the next available channel. Once segment V_i is transmitted, we determine the deadline for the next V_i transmission. If T is the time for the beginning of the last transmitted segment V_i , the next transmit deadline for segment V_i is set to $T + t_i + t_d$, since this is the earliest among the deadlines of all future time. (We assume the receiver is able to record a segment if it reads the header at the beginning of each segment.)
20 We treat the m sub-channels as one channel with the m times the bit rate. δ_i is the transmit time of segment V_i on the single channel (equal to the size of V_i divided by mB).
Alternatively, we keep track of the finishing times on each channel of the last transmitted segment. The next available transmission slot is on the channel with the earliest finishing time. A simple scheme for actual implementation is as follows:

1. Suppose T is the current time. Find the earliest deadline amongst the current deadlines in the list $D[i]$; select this segment for transmission (earliest deadline first). Verify that the deadline chosen is no earlier than T . If not, the current
5 schedule is unfeasible in which case the scheduling fails and the wait time needs to be increased.
2. If the deadline selected is no earlier than T , record or output the selected segment for transmission.
3. To update the next deadline $D[i]$ after V_i is broadcast the new deadline for
10 transmitting the next V_i is given by $T + t_i + t_d$ (see Figure 6).
4. Increase T by δ_i , the time needed for transmitting the video segment V_i .
5. Repeat steps 1-4 until T reaches the end of the time allocated for broadcasting the movie.

In this scheme, $D[i]$ is initialized to $T_0 + t_i + t_d$ when the broadcast begins at time T_0 .

- 15 When a segment is scheduled before the deadline, all the future deadlines for this segment should be moved up. Therefore, scheduling a transmission before its indicated deadline costs resources in terms of bandwidth. An estimate of the "wasted" bandwidth is:

$$\delta/(t_i + t_d)B$$

- 20 where δ is the deadline less the current time, t_d is the delay, t_i is the beginning of the playback time for the i -th segment, and B is the transmission bandwidth. In an alternative method for scheduling, instead of choosing the earliest deadline, we pick the segment with the minimum $\delta/(t_i + t_d)$ in step 1.

The method described above computes a schedule from a predetermined deadline (or rejects the deadline if it is not feasible). We now discuss a method that optimizes the delay

time. In this scheme we use the theorem proposed by Dertouzos (see M. L. Dertouzos, "Control robotics: the procedural control of physical processes" Information Processing vol. 74, 1974) that states: if a feasible schedule exists then the EDF process also produces a feasible schedule.

5 In this process, from the current schedule we reduce the wait time so that the new deadline is the actual realized schedule. Because the schedule is realized and therefore feasible, the EDF is also feasible. However, EDF will in general produce a different (and better) schedule. More specifically, if t_a is the time when the segment v_i is actually broadcast, we should have $t + t_i + D' > t_a$, where D' is the new deadline, and t is the time
10 when the deadline was set (see the algorithm above). We have equivalently $[t + t_i + t_d] + D' - t_d > t_a$, where t_d is the old wait time. Note that the bracketed term contains the deadline used which is equal to $D[i]$. Therefore $t_d - D'$ equals the minimum of $(D[i] - t_a)$ over i at all times. This minimum value can be conveniently calculated from the algorithm above. With new and better delays, we run the scheduling program again to come up with a new schedule.
15 Since the new delays must produce a feasible schedule, we will approach an optimal schedule with this feasible schedule.

The Just-In-Time Transmission Algorithm:

20 An alternative to the EDF schedule is the just-in-time schedule. The just-in-time algorithm schedules each segment i ($i = 1, 2, \dots, n$) to be transmitted as close to its deadline as possible. Channel conflicts involving more than one segment being assigned to the same channel are resolved by moving one of the two segments to an earlier time. In one embodiment, the segment with the larger i is moved because it is broadcast less frequently and therefore requires less bandwidth. We assume that the multimedia presentations are

encoded as constant bit-rate data, thus the transmission time equals the playback time. Note that under a variable bit-rate encoding scheme schedules in the following algorithm should be relative to the end of a segment instead of the beginning of a segment.

The main part of the just-in-time scheduling algorithm contains a loop that schedules the broadcast table $S[]$ (scheduling table 14 in **Figure 1**), and we use a list $L[i]$ ($i=1, \dots, n$) to remember the proposed (but not committed) schedule time for each segment as well as channel (from m channels):

(1) Initialize the broadcast scheduling table: for each of the n segments, call the `find_next_slot` subroutine with $T=0$ and segment index i .

10 (2) Find segment V_i whose $L[i]$ is the smallest (earliest in time), commit V_i to the scheduling table $S[]$ by recording the transmission time, the segment index, and the channel number. Call the `find_next_slot` subroutine with $L[i]$ and i .

(3) Repeat step (2) until the end of the schedule time is reached.

15 `find_next_slot` subroutine:

(1) The next deadline for the segment i at time T is $T+t_i+t_d$, where t_i is the time at the start of the segment measured from the beginning of the movie; and t_d is the specified delay time.

20 (2) Schedule segment i to be transmitted at $t = T+t_i+t_d$. When there are several channels satisfying this condition, choose one at random (say, channel k). Record t and k in $L[i]$.

(3) In case of a collision when the slot is already occupied for all m channels, we need to move one segment from one of the m channels to an earlier time. Let's say that V_j is the segment that

has the highest index number among these m channels. To resolve the collision, find the first empty slot before t (let's say at t_c), and move V_j towards t_c , one time-slot at a time. At each time-slot (t') before t_c , if there is a V_k where $k > j$, replace V_k with V_j . If $t' > T$, set $L[j] = t'$ and then move V_k towards t_c . If $t' \leq T$, also modify the scheduling table $S[]$ to reflect the fact that V_k has been replaced by V_j , and then reschedule V_j and V_k by calling this same routine. Until we reach t_c . Now V_i can be scheduled in the slot V_j previously occupied. See Figure 7 for an illustration of this case.

- (4) Scheduling fails if the collisions cannot be resolved (i.e., an empty time slot cannot be found), or no progress is made after a conflict resolution in step (3).

The Hybrid Method

This alternative method combines features of the earliest deadline first (EDF) and just in time (JIT) processes. In the EDF method, the scheduling is determined by the deadline array D by either the earliest deadline or by minimizing waste in bandwidth. Similar to the EDF procedure, the hybrid method also schedules by minimizing deadlines or wasted bandwidth (or, more generally, any cost function associated with the movie segments), but based on a modified array of deadlines L instead of D . A process similar to that used in the JIT process computes L , the array of n modified deadlines.

We recognize that there may be cases when segments cannot all be broadcast in m channels at their deadlines because of potential overlaps among them. Hence, deadlines in L

are modifications of D in such a way that they are as close as possible to their real deadlines without conflict.

In order to schedule any movie partition, we need a continuous version of a conflict resolution routine to modify deadlines so they can actually be scheduled. thus, we presume
5 that a segment can be scheduled in m channels, and we find the one with minimal waste in bandwidth given by $w(\delta, i) = \delta / (t_i + t_d)$, where δ is the amount the segment must be moved earlier in order to avoid overlapping with other segments already in L . We may also choose to move the existing segment instead of newly inserted one. Each alternative has an associated bandwidth cost. The best choice for a given situation will be the one that
10 minimizes the total bandwidth waste w . Since the deadline in L can actually be scheduled with m channels, these deadlines are more realistic and hopefully produce better overall schedules.

The Periodic Transmission Algorithm

15 In this section, we discuss yet another alternative scheduling method that performs periodic scheduling so that the broadcasting schedule is repeated every period, T_p . The period is optimally integral multiples of the movie length. The most common period is one movie length. In the following discussion we develop heuristic algorithms. We first analyze the required transmitting frequency of each segment, which defines an optimal solution. We
20 then discuss a systematic approach for achieving the optimal solution.

Because of the constraint of periodic scheduling, each segment can be classified according to how many times, k , it must be broadcast in one period T_p . **Figure 4** graphically illustrates the broadcasting of segments over different periods in accordance with this

scheme. An i -th segment needs to be broadcast $k = \left\lceil \frac{T_p}{t_i + t_d} \right\rceil$ times where $\lceil f \rceil$ is the smallest integer that is larger than or equal to f . In the above representation, T_p is the period of the broadcasting schedule, t_d is the delay time and t_i is the playback time for segment i .

We create queues labeled by consecutive integers $q=1, \dots, Q$. Segments with the same k belong to the same queue. n_q demarcates the segments belonging to the same queue: segments in queue q have index i in the range $n_{q-1} < i \leq n_q$ (n_0 is set to zero). The total number of queues, Q , is equal to the number of distinct integers k for $i=1, \dots, n$. Note that the integer k may not be consecutive. For example, the first and second segments need to be transmitted $\left\lceil \frac{T_p}{t_1 + t_d} \right\rceil$ and $\left\lceil \frac{T_p}{t_2 + t_d} \right\rceil$ times, respectively, in one period. (By convention, this

defines the first and the second queues, if two integers are different.) These two integers can in general be different and non-consecutive. Note also that many large- i segments belong to the same queue. For example, if the transmission period is one movie length, approximately $n/2$ of the segments are needed twice in a period. Therefore the total number of queues is much less than n . It is also less than the largest possible $k = \left\lceil \frac{T_p}{t_d} \right\rceil$ since k is non-consecutive.

Figure 5 is a schematic illustration of queues that contain the segment indexes used in a periodic transmission scheme in accordance with an embodiment of the present invention.

If a segment cannot be scheduled in a queue (q) with repeat time k , it will be removed from the queue and be placed in the queue with repeat time $k+1$. If a queue corresponding to $k+1$ does not exist, a new one is created. Q is incremented by 1, and the queues whose indices are larger than q are all incremented by 1.

The segment, i , is successfully scheduled if the time separation between the repeated broadcasting event is less than $t_i + t_d$. Otherwise, the scheduling fails.

In order to facilitate such scheduling, we have the following guidelines:

- Schedule the tight deadlines first (the segments with lower index numbers);
- Move the block that cannot be scheduled to a lower queue;
- Allow local adjustment;
- 5 • Schedule according to a linear graph in order to ensure the segments are evenly distributed (as illustrated in **Figure 4**).

The detailed periodic scheduling algorithm is described as follows

1. Insert each segment i to a queue q according to $k = \left\lceil \frac{T_p}{t_i + t_d} \right\rceil$. k is the number of
10 times the segment is broadcast in one period T_p and q is a consecutive integer labeling the queue starting from large k . n_q is the largest segment index in queue q . Queues are first-in-first-out. Insert the segments starting with small i .
2. Schedule the segments, one from each queue, starting from the largest k . A small value of i denotes a segment that has a tighter deadline.
- 15 3. For segment i with $n_{q-1} < i \leq n_q$ its preferred k time slots are equally spaced and are given by $t_j = \left\lfloor \frac{n}{k} \left(\frac{i - n_{q-1}}{n_q - n_{q-1}} + j \right) \right\rfloor * s$, where $j=0, \dots, k-1$, s is the segment
length in time (assuming they are all the same), and n is the total number of time slots in one broadcasting period. Assign segment i to the scheduling table $S[]$ at
time t_j and choose an available channel from m channels. We can optionally shift
20 all t_j periodically by an integer between 0 and n/k in order to minimize crowding around the neighborhood of t_j . This is done to make the density of the time slots uniformly distributed around the period.

4. If the preferred time slot is occupied already, search for a nearest empty slot. One constraint must be satisfied: the distance between the adjacent slots must be less than $t_i + t_d$ including the distance between the first slot and the last one across the period boundary. Scheduling fails if no empty slot satisfies this constraint.
5. If segment i fails to schedule in queue k in step (4), move the segment to the beginning of the queue that repeats $k+1$ times in a period. Create a queue if necessary, and adjust n_q accordingly. If the repeat time $k+1$ is too large (larger than $\left\lceil \frac{T_p}{t_d} \right\rceil$), scheduling fails, and wait time t_d must be increased.
6. Delete the queue from the set if it has run out of the segments.
7. Repeat steps (2) to (6) until all the segments are successfully scheduled.

Re-initialization of n_q : if a significant number of segments get moved in step (5), the linear placement relationship in step (3) ceases to be valid. Thus, one should reschedule using the new n_q .

- 15 By outputting all scheduled segments in each channel into a separate file while preserving relative timing among them, we can make each file into a pseudo-movie. We can then provide these pseudo-movies to existing head-end transmission systems utilizing multiple channels, and avoid making any changes to the hardware and software configurations of the head-end. Because these files have the periodic property, they can be broadcast repeatedly. The next
- 20 section addresses transitioning between two movies.

Transitioning Between Two Movies

A practical issue in providing VoD service is accommodating schedule transitions from one movie to the next. The present algorithm-based scheduling method has the flexibility to optimize such transitions.

5 Assume a first movie finishes at time T_f . Any viewer that tuned in before T_f is guaranteed to see the entire movie, however, after T_f there is no such guarantee. Assume further that the second movie begins at time T_b , so that any viewer that tunes in after T_b will be able to see the entire second movie. The present algorithms minimize the gap $T_b - T_f$ and also determines a best feasible gap. In this approach we expect $T_b - T_f$ to be small, for
10 example on the order of the receiver latency time. A short introduction to the next movie can be played for example.

 In the case of the just in time algorithm, a movie transition is implemented in the main loop: After T_f , new deadlines need not to be generated after transmission of each segment. At time T_b , we acquired a new set of n deadlines for the second movie. These new
15 deadlines are scheduled all at once in the scheduling table. To resolve any conflicts, the first movie segments are assigned a lower priority and so will be moved first. Similarly in earliest deadline first method, the first movie segments transmitted after T_f will no longer generate new deadlines. At time T_b , a new set of deadlines is generated and competes with the
20 deadlines for the first movie for transmission. In the periodic scheduling approach, the last period of the first movie and the first period of the second movie need to be replaced by a specially designed transition block.

The Receiving Algorithm:

Set-top box 20 implements a receiving algorithm that allows for playback of the requested movie. The algorithm at the receiver is as follows:

1. Let the user select the movie to watch.
- 5 2. Tune to the set of channels that carry the segments of the selected movie.
These channels should be accessible simultaneously.
3. Start receiving data from these channels immediately. Record and store these segments in a temporary buffer such as receive buffer 24. Between the current time and the specified wait time, the set-top box 20 can play back a pre-stored
10 piece of content or can continue playing out the previously viewed channel information or can play out some other content.
4. After the specified wait time, the first video segment of the requested content will have been received. This content can now be processed for viewing according to the encoding/decoding format used (e.g., MPEG-2). In the mean
15 time, the set-top box 20 continues to receive and store data from the channels of interest.
5. Continuously play back the movie at its original bit-rate while concurrently receiving and storing data until the end of the movie, or until the user requests a pause or stop. During a pause, content can be stored in the receive buffer 24
20 for later playback.

Thus a scheme for VoD broadcast has been described. Although the foregoing description and accompanying figures discuss and illustrate specific embodiments, it should be appreciated that the present invention is to be measured only in terms of the claims that follow.

CLAIMS

What is claimed is:

- 1 1. A method, comprising determining a schedule for transmission times of various segments
2 of digital content across multiple channels so as to permit any number of content consumers
3 to begin playback of said segments of digital content from an origination point thereof within
4 a waiting time of a request for such playback.
- 1 2. The method of claim 1 wherein the various segments of digital content together comprise
2 a movie.
- 1 3. The method of claim 2 wherein the schedule is determined according to an earliest-
2 deadline-first (EDF) process.
- 1 4. The method of claim 3 wherein in the EDF process a next transmission time for one of the
2 various segments of digital content is determined by first finding an earliest deadline amongst
3 a list of current deadlines for each of the various segments and selecting this segment for
4 transmission.
- 1 5. The method of claim 4 wherein the earliest deadline so chosen is verified to be later than a
2 finishing time for a last transmitted segment.
- 1 6. The method of claim 4 wherein a new deadline for transmission of the selected segment is
2 determined according to $T + t_i + t_d$, where T is a beginning time for the transmission of the
3 selected segment, i is a segment number for the selected segment, t_i is the playback time of
4 segment i and t_d is the waiting time.

- 1 7. The method of claim 2 wherein a cost function is associated with each of the various
2 segments scheduled for transmission, and a segment with the lowest of the cost functions is
3 selected to be transmitted next.
- 1 8. The method of claim 7 wherein the cost function comprises wasted bandwidth.
- 1 9. The method of claim 2 wherein the schedule is determined according to a just-in-time (JIT)
2 process.
- 1 10. The method of claim 9 wherein the JIT process schedules each of the various segments
2 for transmission as close to a transmission deadline associated with each segment as possible.
- 1 11. The method of claim 10 wherein in the JIT process, conflicts for transmissions over the
2 multiple channels are resolved by scheduling a segment with an earlier playback time closer
3 to its deadline for transmission than a segment with a later playback time.
- 1 12. The method of claim 10 wherein in the JIT process, the transmission deadline associated
2 with a particular one of the segments is determined as a time equal to a current time plus a
3 playback time for that particular one of the segments plus the waiting time.
- 1 13. The method of claim 4 wherein in the EDF process, the deadlines associated with the
2 various segments are computed according to a process wherein conflicts for transmissions
3 over the multiple channels are resolved by scheduling a segment with an earlier playback
4 time closer to its deadline for transmission than a segment with a later playback time.
- 5 14. The method of claim 2 wherein the schedule is determined according to a periodic
6 transmission process.

1 15. The method of claim 14 wherein the periodic transmission process allows a broadcast
2 schedule for the movie to be repeated every period time, the period time being equal to an
3 integral multiple of a length of the movie.

1 16. The method of claim 14 wherein each one of the multiple segments is allocated to a
2 transmission queue number of a transmission schedule table according to a number of times
3 equal to a movie period divided by the sum of the waiting time and a playback time for such
4 one segment.

1 17. The method of claim 15 wherein all of the segments allocated to a single one of the
2 multiple channels form a pseudo-movie, and all such pseudo-movies for all of the multiple
3 channels are input to multiple channels of a transmission head-end.

4 18. A method, comprising:

5 i. dividing a multimedia presentation into sequential segments, each segment
6 having a time length,

7 ii. scheduling transmission of the segments of the multimedia presentation
8 according to a schedule computed according to a specified delay time that
9 does not depend on the time lengths of the segments, and

10 iii. transmitting the segments over a broadcast network according to the schedule
11 for each segment computed in step ii.

1 19. The method of claim 18 wherein a transmission bandwidth of multiple times that of the
2 multimedia presentation is allocated for transmission of the segments and each segment is
3 transmitted repeatedly based on the computed schedule.

- 1 20. The method of claim 18 wherein early segments are transmitted more frequently than
2 later segments.
- 1 21. The method of claim 18 further comprising receiving the segments transmitted over the
2 broadcast network, storing the segments in temporary storage, and playing back the segments
3 as soon as the delay time has elapsed.
- 1 22. A method as in claim 18 wherein each of the segments is scheduled for repeated
2 transmissions at periodic times.
- 1 23. A method as in claim 22 wherein the periodic times for transmission of each respective
2 segments equals time offsets of the beginning of such respective segment plus an operator
3 selected delay time.
- 1 24. A method as in claim 18 wherein segments having earlier transmission deadlines are
2 scheduled first and as soon as possible.
- 1 25. A method as in claim 18 wherein segments are transmitted just-in-time as determined by
2 respective time offsets and the specified delay.
- 1 26. A method as in claim 25 wherein in the case of a conflict where more of the segments are
2 to be transmitted than allocated bandwidth allows, segments later in the presentation are
3 scheduled to be transmitted earlier in nearest empty time slots, giving priority to earlier
4 segments to be transmitted as closely as possible to their scheduled time slots.

1 27. A method as in claim 18 further comprising computing an overlap period between an end
2 of a current presentation and a beginning of a next presentation, to minimize interruptions
3 therebetween.

1 28. A server configured to generate transmission schedules for each of a number of segments
2 of a multimedia presentation to be transmitted over a multiple channels of a broadcast
3 network, said schedules computed according to a specified delay time that does not depend
4 on time lengths of the segments.

1 29. The server of claim 28 wherein the transmission schedules are computed according to one
2 of a just-in-time transmission (JIT) procedure, an earliest-deadline-first (EDF) procedure or a
3 periodic transmission procedure.

1 30. The server of claim 29 wherein according to the EDF procedure a next segment to be
2 transmitted is determined by first finding an earliest transmission deadline amongst a list of
3 current transmission deadlines for each of the segments and selecting this segment for
4 transmission.

1 31. The server of claim 29 wherein according to the JIT procedure each of the segments are
2 scheduled for transmission as close to a transmission deadline associated with each segment
3 as possible.

1 32. The server of claim 29 wherein according to the periodic transmission procedure each of
2 the segments is allocated to a transmission queue according to a schedule that takes into
3 account a period of the presentation, the delay time and a playback time for each segment.

1 33. A receiver configured to receive segments of multimedia presentation from multiple
2 transmission channels simultaneously and to begin playback of the segments in a sequence
3 corresponding to a proper format for the multimedia presentation after a predetermined delay
4 time that is independent of time lengths of the segments.

1 34. The receiver of claim 33 wherein the segments are stored on a local storage medium.

1 35. The receiver of claim 33 wherein the segments are received according to a schedule that
2 was computed according to one of a just-in-time transmission (JIT) procedure, an earliest-
3 deadline-first (EDF) procedure, a combination of aspects of the EDF and JIT procedures, or a
4 periodic transmission procedure.

ABSTRACT

A multimedia presentation is divided into sequential segments, each segment having a time length, the transmission of the segments of the multimedia presentation is then scheduled according to a specified delay time that does not depend on the time lengths of the segments, and the segments are then transmitted over a broadcast network according to the schedule for each segment so computed. Preferably, a transmission bandwidth of multiple times that of the multimedia presentation is allocated for transmission of the segments and each segment is then transmitted repeatedly based on the computed schedule. In cases of conflict, later segments are scheduled earlier and thus transmitted more frequently than desired. Once transmitted, the segments may be received and stored in temporary storage, and then played back as soon as the delay time has elapsed.

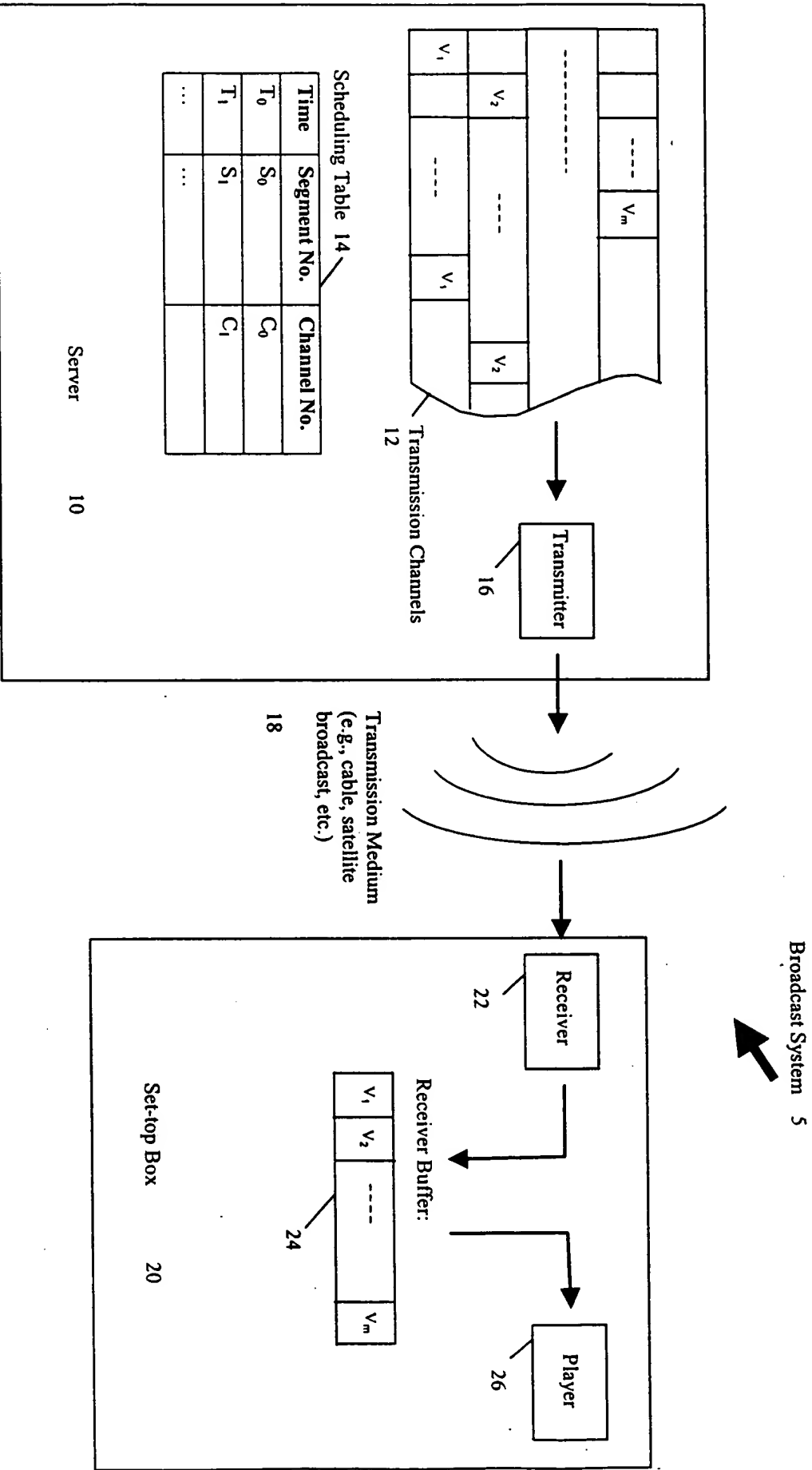


Fig. 1

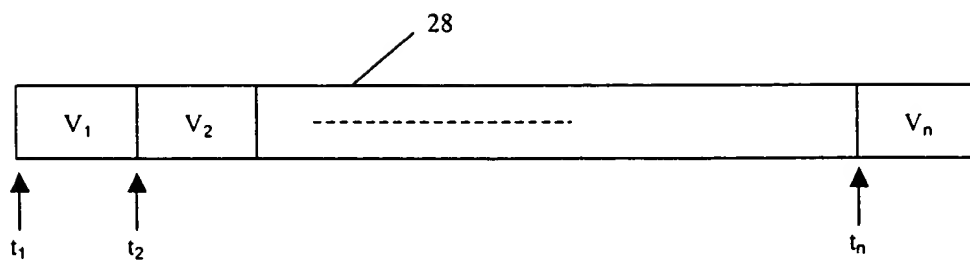


Fig. 2

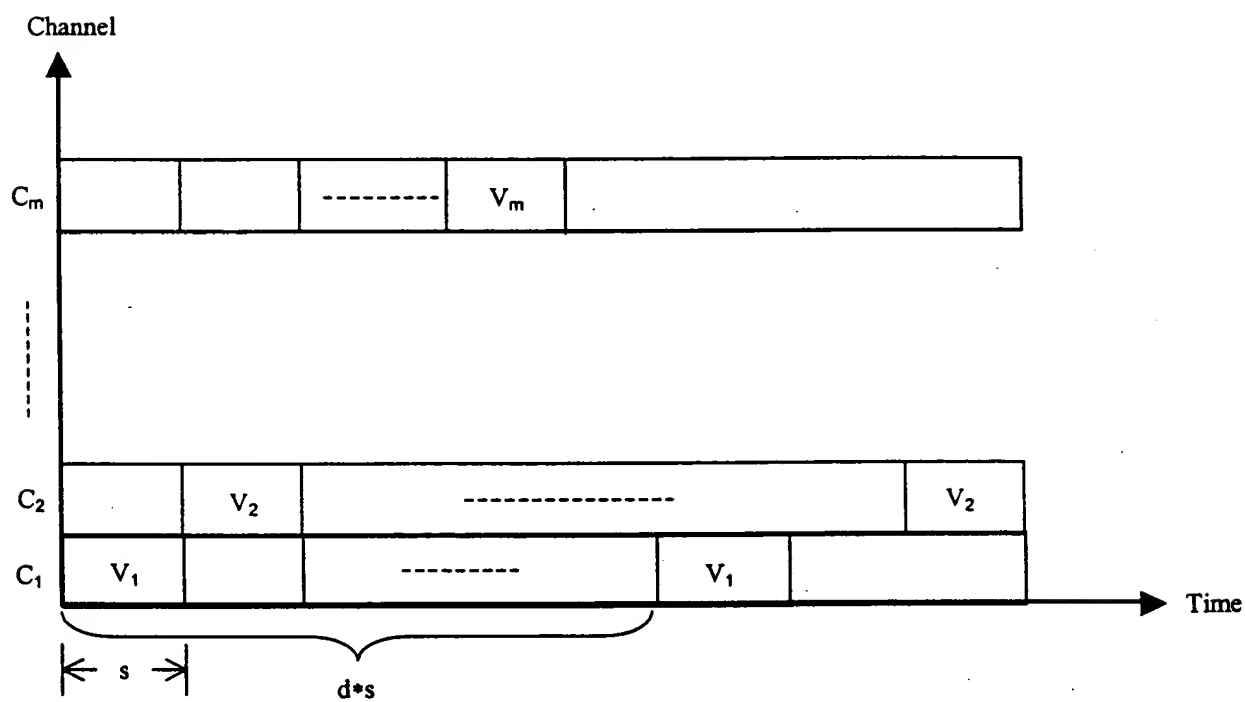


Fig. 3

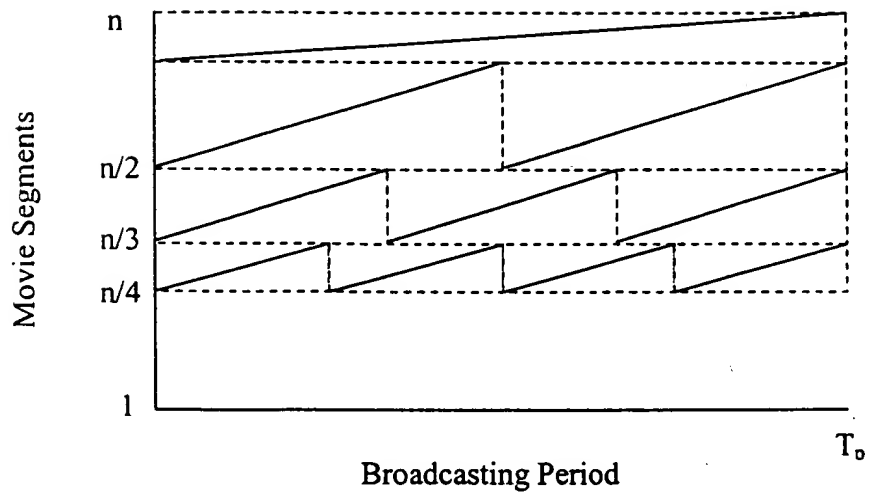


Fig. 4

q	k	i
1	$\left\lceil \frac{T_p}{t_1 + t_d} \right\rceil$	$n_0 (=0), n_1 (=1)$
2	$\left\lceil \frac{T_p}{t_2 + t_d} \right\rceil$	$n_1 + 1, n_2 (=2)$
...
Q-1	2	$n_{Q-2} + 1 \dots\dots n_{Q-1}$
Q	1	$n_{Q-1} + 1 \dots\dots n_Q$

Fig. 5

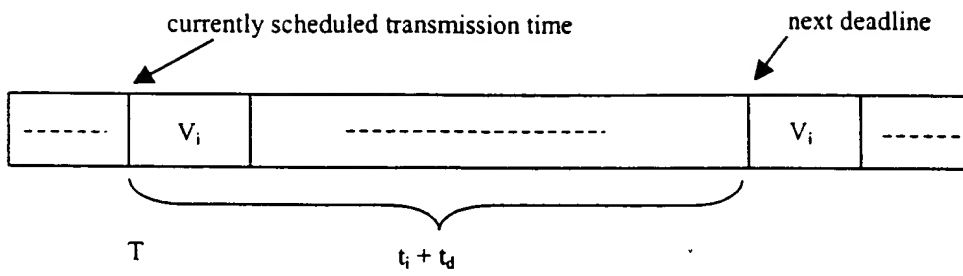


Fig. 6

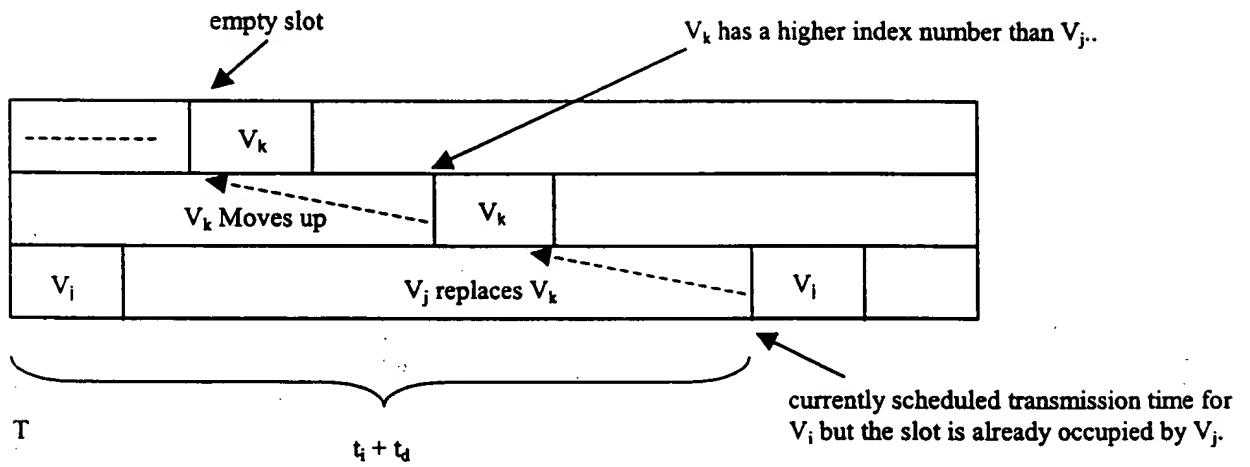


Fig. 7

Applicant or Patentee: Deyang Song Attorney's
Serial or Patent No.: Not Yet Assinged Docket No. 5416P001
Filed or Issued: Herewith
For: METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
37 CFR 1.9 (f) and 1.27(b) – **INDEPENDENT INVENTOR**

As the below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled:

METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK

described in

- ☒ the specification filed herewith.
☐ application serial no. _____, filed _____.
☐ patent no. _____, issued _____.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey or license any rights in the invention is listed below:

- ☒ No such person, concern, or organization.
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(37 CFR 1.27)

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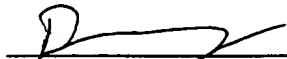
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

DEYANG SONG

NAME OF INVENTOR



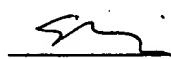
Signature of Inventor

1/5/2001

DATE

SHOUDAN LIANG

NAME OF INVENTOR



Signature of Inventor

1/5/2001

DATE

NAME OF INVENTOR

Signature of Inventor

DATE

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

METHOD FOR DIGITAL MEDIA PLAYBACK IN A BROADCAST NETWORK

the specification of which

[illegible]

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above. I do not know and do not believe that the claimed invention was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (for a utility patent application) or six months (for a design patent application) prior to this application.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

<u>Prior Foreign Application(s)</u>			<u>Priority Claimed</u>	
(Number)	(Country)	(Foreign Filing Date - MM/DD/YYYY)	Yes	No
(Number)	(Country)	(Foreign Filing Date - MM/DD/YYYY)	Yes	No
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I hereby claim the benefit under title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below:

<u>60/175,166</u>	<u>01/07/2000</u>
(Application Number)	(Filing Date – MM/DD/YYYY)
 (Application Number)	 (Filing Date – MM/DD/YYYY)

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:


<u>(Application Number)</u>	<u>(Filing Date – MM/DD/YYYY)</u>	<u>(Status -- patented, pending, abandoned)</u>
 (Application Number)	 (Filing Date – MM/DD/YYYY)	 (Status -- patented, pending, abandoned)

I hereby appoint the persons listed on Appendix A hereto (which is incorporated by reference and a part of this document) as my respective patent attorneys and patent agents, with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

Send correspondence to Tarek N. Fahmi, BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP, 12400 Wilshire Boulevard 7th Floor, Los Angeles, California 90025 and direct telephone calls to Tarek N. Fahmi, (408) 720-8300.
(Name of Attorney or Agent)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

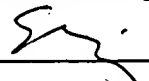
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APPENDIX A

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APPENDIX B

Title 37, Code of Federal Regulations, Section 1.56 Duty to Disclose Information Material to Patentability

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

- (1) Prior art cited in search reports of a foreign patent office in a counterpart application, and
 - (2) The closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.
- (b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and
- (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or
 - (2) It refutes, or is inconsistent with, a position the applicant takes in:
 - (i) Opposing an argument of unpatentability relied on by the Office, or
 - (ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

- (c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:
- (1) Each inventor named in the application;
 - (2) Each attorney or agent who prepares or prosecutes the application; and
 - (3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.
- (d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.

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To: Chris Song <chris_song@yahoo.com>
cc: shoudanl@yahoo.com
Subject: Re: Hi

Deyang and Shoudan:

Attached is a draft of the patent application based on your earlier materials. Please review the application at your convenience. I would like to postpone our meeting (originally scheduled for today at 3 pm) until you have reviewed the draft. Therefore, please let me know when a good alternative would be. I can meet this Wednesday if that works for you.

During your review of the application please check for technical accuracy and completeness. Do not hesitate in making any changes.

Also, please keep in mind that you have a continuing duty to disclose to the Patent and Trademark Office information you are aware of that is material to patentability. If, for example, you are aware of any articles, patents, sales brochures or other documents bearing on your invention, please bring them to our attention. Also, you must disclose your preferred way of carrying out the invention. For instance, if there are special materials or configurations that you prefer, they must be set forth in the application.

It is our understanding that the invention has not been patented or described in a printed publication in this or a foreign country, or in public use or on sale in this country, more than one year before the date that we intend to file this application. Please let us know if you believe otherwise.



Patent Application.zi

Regards,
Tarek N. Fahmi
Blakely, Sokoloff, Taylor & Zafman LLP
1279 Oakmead Parkway
Sunnyvale, CA 94085-4040
Tel: 408.720.8300
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